Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment	)	ET Docket No. 02-135
by the Spectrum Policy Task Force	)	
	)	
	)	
To: The Commission		

COMMENTS OF

Statewide Wireless Network

New York State Office for Technology

6C Executive Park Dr.

Albany, NY 12203-3716

July 8, 2002

Contents

Appendices

I. Introduction

1. These comments from the Statewide Wireless Network, under the New York State Office for Technology, present the views and concerns of the State of New York with regard to FCC ET Docket No. 02-135. This Solicitation of Public Comment is an effort by the Commission to address the need to improve and enhance its spectrum policies as we continue forward in the 21st century. We applaud the Commission for creating a forum to address the changes necessary to update and improve upon it spectrum policies.

2. The New York State Office for Technology, on behalf of the State of New York, is in the process of procuring a new Statewide Wireless Network (SWN) for State, Federal and Local governmental entities that operate within or in the proximity of New York State's geographic borders. SWN will provide an integrated mobile radio communications network that will be utilized by both Public Safety and Public Service agencies in New York State. It will provide a digital, trunked architecture that will offer both voice and data capabilities. It will be used in day-to-day operations, as well as for disaster and emergency situations, to more effectively and efficiently coordinate the deployment of all levels of government resources to such incidents. It will also enhance international coordination along the US/Canadian border, and will play a critical role in supporting the homeland defense efforts within and immediately surrounding the State of New York.

3. Although the intent of this proceeding is admirable, the State of New York feels strongly that the timeline for submitting comments under this Notice was too short[1], especially in

[1] See Request for Extension filed by New York State Office for Technology, June 24, 2002, and subsequent denial by the Chief, Office of Engineering and Technology, released July 2, 2002, DA 02-13558.

light of the two other major Public Safety proceedings[2] which have the same deadline for comment as this Notice. The Commission should be more flexible in the future when multiple proceedings that impact the same radio service category are due simultaneously.

4. As will be noted later within this document, this Task Force would benefit from an analysis of the material provided under these other public safety proceedings, since they are directly relevant to the questions posed within this Notice.

5. Within these comments are references to the Public Safety Wireless Advisory Committee (PSWAC) Final Report[3]. The Task Force should carefully study the public safety needs identified in the PSWAC Subcommittee Final Reports; in particular: Annex A, pp. 76 (150) - 81 (155)[4] and Annex B, pp. 82 (156) - 112 (186)[5] of the Operational Requirements Subcommittee Final Report; Appendix B, p. 79 (269)[6] and Appendix C, pp. 80 (270 - 84 (274)[7] of the Technology Subcommittee Final Report; and Appendix C, pp. 65 (671) - 79 (685)[8] and Appendix D pp. 80 (686) - 105 (711)[9] of the Spectrum Requirements Subcommittee Final Report. Given the short time frame available to the Spectrum Policy Task Force, this review should be a priority.

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[2] WT Dockets 02-55, and 00-32. On June 28, 2002, WT Docket 02-55 was extended until August 7, 2002.

[3] FINAL REPORT OF THE PUBLIC SAFETY WIRELESS ADVISORY COMMITTEE TO THE FEDERAL COMMUNICATIONS COMMISSION, Reed E. Hundt - Chairman, AND THE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, Larry Irving - Assistant Secretary of Commerce for Communications and Information, September 11, 1996

[4] Included herewith as Appendix 1.

[5] Included herewith as Appendix 2.

[6] Included herewith as Appendix 3.

[7] Included herewith as Appendix 4.

[8] Included herewith as Appendix 5.

[9] Included herewith as Appendix 6.

II. *HOW CAN SPECTRUM USE, CONGESTION AND DEMAND BE ACCURATELY MEASURED AND PREDICTED?*

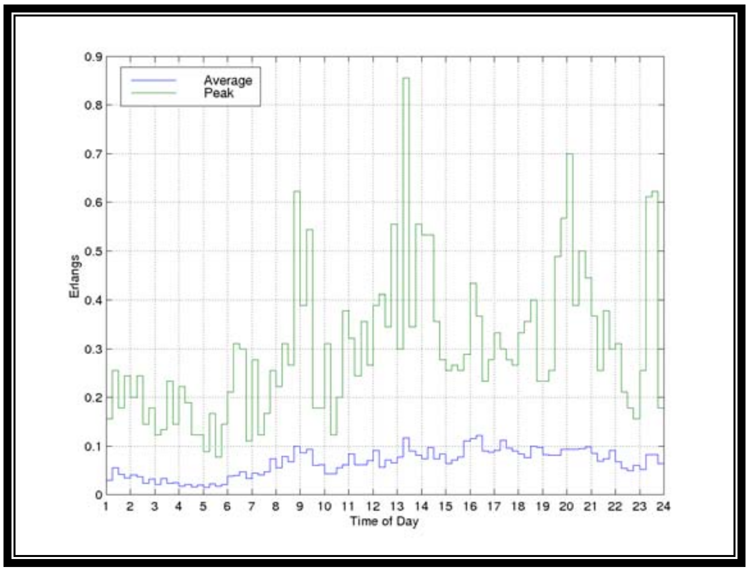
6. During the course of the SWN project, New York State has collected and analyzed data on millions of voice and data transmissions in order to characterize both the profiles and loading levels of various public safety services under diverse conditions[10]. Public Safety communications can be thought of as having two main components, the "static" loading due to periodic and known operational processes (such as shift changes, roll call, etc), and "incident-driven" loading caused by quasi-random events.

7. Although incident-driven loading appears random in character, it is often highly correlated with other processes, such as rush hour traffic, time-dependent crime statistics, etc. With regard to the incident-driven random component, the spectrum needs of Public Safety are problematic to measure, since they typically peak during incidents that are difficult, if not impossible to predict. Making these measurements even more difficult is the fact that Public Safety currently operates across a wide range of frequencies with heavy utilization of High and Low Band VHF, UHF, and 800 MHz, often with little or no interoperability and intercommunications between these bands.

8. Some examples of single-channel, peak and average loading levels are shown in the following Figures, both as a function of time of day, and over the course of multiple days[11]. While the average loading levels are relatively small (approximately 0.05 Erlangs), the peak levels are quite extreme, rising at times to over 0.85 Erlangs - approximately the upper limit on what is achievable on a single radio channel. This clearly shows that, although an Erlang metric can be recorded, the actual user's needs are

[10] Ranging from "quiet" to Disaster conditions.

not captured by these measurements - since a necessary level of Grade of Service (blocked/delayed communications probability) has often not been maintained during the measurements[12]. Therefore, Public Safety networks must be designed to provide sufficient "worst-case" capacity. The Commission's loading rules[13] have long prevented Public Safety from realizing the resources necessary to effectively serve the Public to the highest degree possible.



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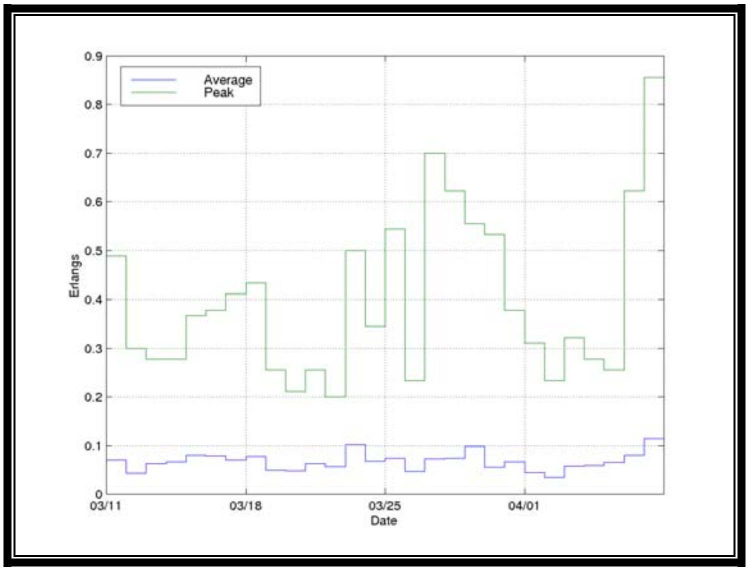
[11] Overlapped fifteen-minute windowing was applied when generating these profiles

[12] In other words, as the user's needs for airtime increase (for example in an emergency situation), the amount of airtime that is actually available decreases as the channel resource is quickly consumed.

[13] For example: *§90.313(a)(1)* requires a **maximum** channel loading of 50 mobiles per channel in the Public Safety Pool for 470-512 MHz; while for 806-824/851-869 MHz, *§90.631(b),* for trunked operations, requires a **minimum** of 70 mobiles per channel or 100 per channel + one channel, and *§90.633(b)*, for conventional operations, requires a **minimum** of 70 mobiles per channel for exclusivity {emphasis added}, Compare this to PSWAC - see Appendix 6, Section 5 .



9. In terms of predicting spectrum needs, the Public Safety community (including equipment Manufacturers) has already expended a significant effort both in investigating and documenting these matters. The Task Force should analyze the PSWAC Final Report, including the Subcommittee Final Reports contained therein. The Task Force, at an absolute minimum, needs to review the following material from this Report and it's Appendices: *Appendix A - Operational Requirement Subcommittee Final Report, Appendix B - Technology Subcommittee Final Report*, and *Appendix D - Spectrum Requirements Subcommittee* (SRS) *Final Report*. In particular, Appendix D of the SRS Final Report, "Public Safety Wireless Communications User Traffic Profiles and Grade of Service Recommendations", 13 March 1996, prepared by Dr. Gregory M. Stone, INS/CECOM, United States Department of Justice, Immigration and Naturalization Service Headquarters Radio Services Section, pp. 80 (686) - 105 (711)[14] should be carefully studied by the Task Force. Command of this material is essential to understanding the spectrum needs of Public Safety.

[14] Included herewith as Appendix 6.

10. The SRS analysis of spectrum needs through the year 2010 was based on very aggressive spectrum efficiencies, which have not been achieved in the market place to date. Given the lag between product availability and general use, it is reasonable to expect that the need for additional spectrum by Public Safety will be greater than predicted.

III. Interference Protection

11. In reference to the Task Force Inquiries relating to interference protection, we direct the Task Force to our comments and the comments of others under the recent NPRM - *Improving Public Safety Communications in the 800 MHz Band and Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels*, WT Docket No. 02-55. The primary focus of this NPRM is to alleviate interference within the 800 MHz band. Not only will the Task Force find comment on means to avoid and or resolve interference, but they will also discover instances and examples of where past policy decisions have led to wide ranging and large-scale interference between services. The issue of power limits at service area boundaries, out of band emission levels, receiver standards, and spectral purity are all raised and commented upon within this proceeding. Reply Comments under this Docket should serve to provide further information on these issues.

IV. Spectrum Efficiency

12. The State of New York understands that spectrum efficiency is a problematic issue to address. The State only notes that when measuring spectrum efficiency, care must be taken to ensure that similar quality of service metrics are employed.

13. For example, one measurement of spectrum efficiency may be the number of voice channels (or voice "slots", "paths", etc) per unit occupied bandwidth. However, care must be taken that when comparing the spectrum efficiencies of different technologies that:

a. The spectrum efficiency must be referenced at similar voice quality levels;

b. The voice quality metric needs to be evaluated on a consistent channel or channel model; and

c. The spectrum efficiency must correspond to some level of spectral purity or out-of-band emission (OOBE) level.

14. Alternatively, a measure of spectrum efficiency may be one that measures data rates per unit bandwidth. In this case:

a. The data rates must correspond to only payload data, and not error detection and correction (EDAC), addressing, or media access control (MAC) overheads;

b. The data rates must be referenced to either similar corrected BER levels or to error free reception within a consistent channel or channel model; and

c. The spectrum efficiency must correspond to some level of spectral purity or OOBE level(s).

V. Public Safety Communications

15. In reference to Public Safety Communications, we again direct the Task Force to our comments, and the comments of others filed under the recent NPRM - Improving Public

Safety Communications in the 800 MHz Band and Consolidating the 900 MHz Industrial/Land Transportation and Business Pool Channels, WT Docket No. 02-55. Reply comments under this Docket should serve to provide further illumination of these issues.

16. We further direct the Task Force to the continuing proceeding, WT Docket 00-32, IN THE MATTER OF THE 4.9 GHZ BAND TRANSFERRED FROM FEDERAL GOVERNMENT USE, with comments on it's SECOND REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULE MAKING.

17. Finally, we direct the Task Force also to the PSWAC[15] report, whose analyses and recommendations were the culmination of a year's effort, and represent the needs, concerns, and recommendations of Public Safety projected out to the year of 2010. In particular, the focus of that report was to determine and present the amount of spectrum that needed (and still needs) to be dedicated for the support of Public Safety operations. This report's conclusion on spectrum needs has not diminished, and in fact, in light of the recent terrorist attacks upon the US, the Public Safety community has taken on the additional role of the front line for homeland defense. Although some progress has been made to free additional spectrum for Public Safety[16], thus far both the U.S. DTV Plan and the current border arrangements with Canada and Mexico appear to have significant negative impact on this additional spectrum in New York State.

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[15] id

[16] WT Docket 98-86, The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communication Requirements Through the Year 2010

16. The State strongly opposes any policy that would attempt to time-share Public Safety spectrum with non-Public-Safety or commercial entities. Through the National Public Safety Telecommunications Council (NPSTC), the State is an active participant in the Software-Defined-Radio (SDR) Forum, and as such, tracks the capabilities of current Software radios, as well as those expected to be available in the near future. Through this involvement, the State notes that the ability to intelligently time-share Public Safety spectrum with other services is not a capability that appears to be practically deployable without some degradation to Public Safety Operations, either in terms of interference, or call blocking. Ideally the availability of Public Safety spectrum to commercial interests could be "locked-out" in times of crisis, but the logistics of employing such functionality reliably can quickly prove prohibitive.

VI. International Issues

19. The State has long felt that the Commission needs to develop better avenues for dealing with international coordination issues. The State has petitioned the Commission to work toward a harmonization of the 700 MHz band between the US and Canada, but has yet to receive any substantive response in regards to this issue[17].

20. Spectrum harmonization is an issue that spans both the public safety and economic realms. With regard to public safety, the need to police and control our respective borders is now more important than ever. A critical resource to meeting this objective is

[17] See *New York State's Analysis of the Canadian DTV Transition Allotment Plan and Recommendations,* presented as part of the record to the FCC Public Safety National Coordination Committee at its San Francisco, CA meeting on January 28, 2000 - Appendix 7. A subsequent, more detailed recommendation, dated August 28, 2000, was submitted by our consultant to the FCC Chairman, Secretary, and Chief, Planning & Negotiations Division, International Bureau. (Cover letter - Appendix 8.)

harmonized public safety spectrum, which facilitates both coordination and interoperability between the law enforcement agencies of both countries. With regard to economics, free trade and tourism revenues depend upon homogenous communications services between neighboring countries. Furthermore, standards-based technologies drive the growth of the telecommunications industry, as well as local and national economies. Without a similar harmonization of the spectrum resources utilized by these standards, the technologies and services cannot flourish, and those aspects of the respective economies suffer as a result.

21. We are living in a global community, with intertwined economies and nearly identical requirements for the protection of our people. The commission needs to work to develop policies that reflect a broader North American outlook.

VII. Conclusion

22. New York State recommends that the Commission review specific parts of the PSWAC Final Report, in particular the cited pages included in the appendices of this filing. We further recommend that the Commission learn from the current 800 MHz interference problems and apply engineering considerations to channel allocations so that problems, now recognized in WT Docket 02-55 can be prevented in the future. The Commission must take positive steps to:

- increase spectrum efficiency,
- to more rapidly make channel reallocation happen, and
- to negotiate a timely solution for harmonized spectrum utilization along our international borders,

so that more useable spectrum can be made available as soon as possible.

Respectfully Submitted,

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Appendix 1

Annex A of the PSWAC Operational Requirements Subcommittee Final Report pp. 76 (150) - 81 (155)

Note 1: In regard to references herein to TIA TR8.8, that task group is now identified as a full engineering subcommittee - TIA TR-8.18 Wireless Systems Compatibility Subcommittee, whose principal work product is Telecommunications Systems Bulletin TSB-88 and its subsequent updates.

Note 2: The term DAC, which is not defined and only appears in several places in Annex A, would appear to be a typographical error that should read DAQ - Delivered Audio Quality, a term that is herein described in some detail.

ANNEX A - OPERATIONAL REQUIREMENTS FOR COMMUNICATIONS QUALITY

SECTION I: Audio and Data Transmission

Audio Quality

A method of quantifying audio quality has been developed by the Telecommunications Industry Association (TIA) in conjunction with the Institute of Electrical and Electronics Engineers (IEEE), and published in a TIA report entitled “A REPORT ON TECHNOLOGY INDEPENDENT METHODOLOGY FOR THE MODELING, SIMULATION AND EMPIRICAL VERIFICATION OF WIRELESS COMMUNICATIONS SYSTEM PERFORMANCE IN NOISE AND INTERFERENCE LIMITED SYSTEMS OPERATING ON FREQUENCIES BETWEEN 30 AND 1500 MHZ”, April 29, 1996.

The principal metric involves recipient understanding and whether or not repetition is required. The metric is called Delivered Audio Quality and consists of a 5 point scale. The lowest value is one, referring to the worst case where the message in unreadable and therefore unusable. The highest is five, where speech is easily understood , no repetition is necessary and noise or distortion components are not introduced in the communications channel. The intermediate values range in the ease of understanding and the frequency of repetition required as well as the nuisance contribution of noise and distortion components introduced along the way.

The basis of understanding uses the equivalent intelligibility of a TIA test value for static receiver sensitivity called SINAD. This refers to a ratio of signal to noise and distortion. These values are subjective and will have variability amongst individuals as well as configurations of equipment and distractions such as background noise. They are intended to represent the mean opinion scores of a group of individuals, thus providing a target for evaluation.

The following table from the report sets out the target equivalency between DAQ (Delivered Audio Quality) and TIA SINAD measurements.

Delivered Audio Quality	Subjective Performance Description	SINAD Equiv. Intelligibility
1	Unusable, Speech present but unreadable	<8dB
2	Understandable with considerable effort. Frequent repetition due to Noise/Distortion	12 dB

Delivered Audio Quality	Subjective Performance Description	SINAD Equiv. Intelligibility
3	Speech understandable with slight effort. Occasional repetition required due to Noise/Distortion	17 dB
3.4	Speech understandable without repetition. Some Noise/Distortion	20 dB
4	Speech easily understood. Occasional Noise/Distortion	25 dB
4.5	Speech easily understood. Infrequent Noise/Distortion	30 dB
5	Speech easily understood.	>33 dB

Values less than three (3) transition quickly so no intermediate definitions exist. Values greater than three (3) contain intermediate steps. The specific value of 3.4 was derived from a specific Federal Government design criterion. Different radio bandwidths and modulations require different ratios of signal versus the combined disruptive effect of noise and interference. Additional details are available in the report. In paragraph 3.4.1 of the TIA TR8.8 report referenced above, it states:

> The goal of DAQ is to determine what mean C/(I+N) is required to produce a subjective audio quality metric under Raleigh multipath fading. The reference is to FM analog radio SINAD equivalent intelligibility. That is a static analog measurement so the Table 1 description (see the table above) has been provided to provide a cross reference.
>
> ... (Channel Performance Criterion) CPC requirements would normally specify either a 3 or 3.4 DAC at the boundary of a protected service area.

Radio systems for public safety should be designed to provide the users with a DAQ of 3.4 so that over the vast majority of the coverage area speech is easily understood.

An equivalent to DAC can be derived for digital systems. It is related to the Bit Error Rate (BER). However, the DAC - BER relationship depends on the specifics of the error correction algorithm, vocoder and related performance of the particular digital platform.

The report also includes methodologies to allow system design, specification, and verification of desired audio quality levels for a given reliability percent of the coverage area. Procurement specifications should detail the desired DAQ and the percentage of the service area that must achieve the required DAQ as well as the acceptance testing methodology to be used.

Data Performance

Additional studies are required in this area, including video. Data performance impacts system loading due to retries (repetition). The length of the data file and whether or not acknowledgments are utilized effect the overall system loading. We encourage TIA to continue its efforts to include data and video in this or a similar report.

SECTION II: Other Quality Considerations

In addition to the quality in technical performance related to voice clarity, other areas of quality may be considered by the public safety users and manufacturers. An integral part of the design and production of public safety radio products and services is the implementation of traditional quality control and quality assurance activities. While each public safety entity has unique user requirements related to quality, the following list gives examples of areas where quality may be an operational requirement. This list is in no way exhaustive, and no effort has been made to establish or suggest numerical recommendations, but gives suggestions of areas in which public safety entities may require a specific quality measurement when designing their systems.

Delay:

For terrestrial systems, the maximum amount of system delay should be limited to the following criteria as is stated in the APCO Project 25 Statement of Requirements:

Throughput delay shall be as follows:

a. Less than 250 msec in direct radio-to-radio communications.
b. Less than 350 msec in radio-to-radio communications through a single conventional repeater.
c. Less than 500 msec in radio-to-radio communications within an RF subsystem.

For satellite systems, an additional system delay should be limited to 250 msec.

Reliability:

System Failures: What is the mean time between system failures?

System Repair: What is the mean time for system repair?

System Redundancy: If the system fails is there system redundancy?

System Durability: What are the durability test results? (e.g. driven rain or drop test?)

Diagnostics: What methods are in place to monitor and report on degradations prior to failure modes?

Ergonomics:

Legibility of Display: Is the display readily readable?

Lighting: Are displays readable in varying ambient light?

Radio Design: Is the radio comfortable to wear and user?

Keypad: Are the buttons big enough? Can the radio be used with gloves?

After Market Services:

Repair: Are repair parts and service supported?

Training: Is there training associated with maintenance, repair and use?

Software Releases:

Are software upgrades user friendly?

Field Programmable:

Program Radio in Field: Can the radio be programmed in the field?

Throughput:

Throughput rate: How long does it take to get the communication?

Retry rate: How long does it take to get the retried communication?

Environmental

Recycling: Is there a method of recycling batteries?

Is there a method for recycling packaging materials?

Radio Coverage:

In paragraph 3.6.2.2 of TIA TR8.8 it states:

For law enforcement and/or other public safety agencies, it is recommended that the CPC (Channel Performance Criterion) be applied to 97% of the prescribed area of operation in the presence of noise and interference. Law enforcement and public safety systems should be designed to support the lowest effective radiated power subscriber set intended for primary usage. In most instances this will necessitate systems be designed to support handheld/portable operation.

This subcommittee accepts the recommendation of TIA TR8.8. Using Figure 1 of that document, 97% area coverage translates to approximately 90% coverage at the contour representing the fringe of coverage.

DISCUSSION

Coverage Area

When describing land mobile performance, two numbers are frequently quoted in percent. The first is the percent area coverage at the fringe contour of the coverage area. In the referenced TR-8.8 document, Figure 1, pp. 7 the relationship between total area coverage and that coverage at the fringe is presented. 95 percent area coverage translates into about 82 percent coverage at the fringe. I do not believe this was the intent of the subcommittee but 95 percent fringe coverage translates to 99 percent area coverage. From TR-8.8, paragraph 5.8, the margin in the design required for each of these is 10.2dB and >14dB respectively. It is my understanding that it was the intent of ORS that the coverage at the total area coverage should be 97 percent. This translates to a fringe coverage of 90% with a total margin of 11.5 dB required to obtain this level of coverage. These numbers are summarized below. In fact, the recommendations of TR-8.8 for public safety in section 3.6.2.2 is for the 97% area coverage as shown above.

% COVERAGE CONTOUR	AREA	MARGIN dB
82	95	10.2
90	97	11.5 < Recommendation
95	99	> 14

Coverage Time and DAC

From TR-8.8, it says “The goal of DAC is to determine what mean C/(I+N) is required to produce a subjective audio quality metric under Raleigh multipath fading .... (Channel Performance Criterion) CPC requirements would normally specify either a 3 or 3.4 DAC at the boundary of a protected service area." Percent time availability is usually associated with Raleigh fading. So, by specifying the percentage time parameter and DAC, the ORS was being redundant. Further, it appeared that the members of the subcommittee were applying DAC over the total area of coverage, not at the coverage boundary.

Safety

Channel Access Time: How long does it take to get an open channel?

Speaker Identification:

Ability to identify speaker: Can you identify who is speaking?

Batteries

Battery Life: Do the batteries meet the needs of your organization? (e.g. can they last for an entire shift without recharging?)

Value

Consistent value: What is the quality per unit dollar?

Alternatively, some public safety entities may view Quality in a more defined structure. In general, all equipment may need to conform to industry standards to be of the highest quality and reliability. All materials should be the best of their respective kinds, free of corrosion, scratches, indentations, or other such defects. The design an construction of the communications equipment should be performed in a neat and craftsman like manner and should be consistent with good engineering practices.

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Appendix 2

Annex B of the PSWAC Operational Requirements Subcommittee Final Report pp. 82 (156) - 112 (186)

[This Annex, as published - 9/11/96, only included data in Sections B-1-A and B-2-A.]

ANNEX B - SPECTRUM CALCULATION INPUT DATA BASED UPON USER NEEDS

The purpose of this section is to describe the method used to develop the public safety input data projections for the year 2010 to be used in the calculation of spectrum need. These parameters are:

1) Population - the number of people in the various agencies, listed by general category of Police, Fire, EMS and General Government. It should be noted that in some jurisdictions, Fire and EMS have become merged into a single agency function. In the equation for calculating spectrum need, this parameter is abbreviated as POP. The material describing population is found in section B-1.

2) Penetration - the percentage of the identified population that will use a particular type of radio communication. In the equation for calculating spectrum need, this parameter is abbreviated as PEN. The material describing penetration is found in section B-2.

The following sections will provide information for the New York and Los Angeles Metropolitan Areas as follows:

B-1-A Population Data for state and local Governmental entities in the 31 county, New York Metropolitan Area - FCC Public Safety Region 8.

B-1-B Population Data for federal government agencies in the 31 county, New York Metropolitan Area - FCC Public Safety Region 8.

B-1-C Population Data for state and local governmental entities in the 5 county, Los Angeles Metropolitan Area.

B-1-D Population Data for federal government agencies in the 5 county, Los Angeles Metropolitan Area.

B-2-A Penetration Data for state and local governmental entities in the 31 county, New York Metropolitan Area - FCC Public Safety Region 8.

B-2-B Penetration Data for federal government agencies in the 31 county, New York Metropolitan Area - FCC Public Safety Region 8.

B-2-C Penetration Data for state and local governmental entities in the 5 county, Los Angeles Metropolitan Area.

B-2-D Penetration Data for federal government agencies in the 5 county, Los Angeles Metropolitan Area.

B-2-E Aggregate Penetration Data, derived for each category of communication service offering from the sum of the preceding four spreadsheet penetrated population sums divided by the sum of the two area total populations.

The data from these sections are summarized as follows:

1. New York Metropolitan Area - State and Local Government:

SUMMARY PENETRATION AND POPULATION DATA:

AREA	VOICE DISPATCH	VOICE INTERCON	TRANSACT PROCES'G	FACSIMILE	SNAP SHOT	REM FILE ACCESS	SLO SCN VIDEO	FULL MO VIDEO	2010 POPULATION BY CATEGORY	% USER CATEGORY POPULATION OF TOTAL REGION 8 POPULATION
POLICE	53.12%	11.58%	31.25%	6.71%	28.79%	23.34%	1.87%	12.24%	83,229	0.39%
FIRE	39.62%	11.29%	31.48%	10.53%	16.83%	28.12%	1.04%	19.54%	153,321	0.73%
EMS	35.67%	11.34%	34.20%	14.13%	30.99%	30.99%	13.60%	3.52%	51,909	0.25%
GENERAL GOV'T SERVICES	20.69%	1.29%	16.16%		0.71%	0.91%	2.54%	0.59%	251,138	1.19%

TOTAL REGION 8 AREA POPULATION = 21,099,700

2. New York Metropolitan Area - Federal Government:

SUMMARY PENETRATION AND POPULATION DATA:

AREA	VOICE DISPATCH	VOICE INTERCON	TRANSACT PROCES'G	FACSIMILE	SNAP SHOT	REM FILE ACCESS	SLO SCN VIDEO	FULL MO VIDEO	2010 POPULATION BY CATEGORY	% USER CATEGORY POPULATION OF TOTAL REGION 8 POPULATION
POLICE										
FIRE										
EMS										
GENERAL GOV'T SERVICES										

TOTAL REGION 8 AREA POPULATION = 21,099,700

3. Los Angeles Metropolitan Area - State and Local Government:

SUMMARY PENETRATION AND POPULATION DATA:

AREA	VOICE DISPATCH	VOICE INTERCON	TRANSACT PROCES'G	FACSIMILE	SNAP SHOT	REM FILE ACCESS	SLO SCN VIDEO	FULL MO VIDEO	2010 POPULATION BY CATEGORY	% USER CATEGORY POPULATION OF TOTAL LOS ANGELES POPULATION
POLICE										
FIRE										
EMS										
GENERAL GOV'T SERVICES										

TOTAL LOS ANGELES AREA POPULATION =

4. Los Angeles Metropolitan Area - Federal Government:

SUMMARY PENETRATION AND POPULATION DATA:

AREA	VOICE DISPATCH	VOICE INTERCON	TRANSACT PROCES'G	FACSIMILE	SNAP SHOT	REM FILE ACCESS	SLO SCN VIDEO	FULL MO VIDEO	2010 POPULATION BY CATEGORY	% USER CATEGORY POPULATION OF TOTAL LOS ANGELES POPULATION
POLICE										
FIRE										
EMS										
GENERAL GOV'T SERVICES										

TOTAL LOS ANGELES AREA POPULATION =

5. Aggregate Penetration:

	VOICE DISPATCH	VOICE INTERCON	TRANSACT PROCES'G	FACSIMILE	SNAP SHOT	REM FILE ACCESS	SLO SCN VIDEO	FULL MO VIDEO
ALL SERVICES								

PSWAC Operational Requirements - Appendix B-1-A

New York Metropolitan Area Operational Needs
Report On Population (POP)

The purpose of this section is to describe the method used to develop the state and local public safety population projection for the year 2010. This parameter, population, is a required input to the future needs equation being solved by the overall PSWAC process. Population has been given the abbreviation POP.

The population determined in this section **does NOT include any values for the federal government** needs within the boundaries of the New York Metropolitan Area, or the needs for interoperability in the region. These needs, must be added to the population determined in this document in order to arrive at the total population for the New York Metropolitan Area.

I. DEFINITION OF NEW YORK METRO AREA

The New York Metropolitan Area is defined as the 31 counties of Connecticut, New York, and New Jersey which make up NPSPAC Region 8. NPSPAC Region 8 is the New York Metropolitan Area per FCC Docket PR 87-112 which allocated six MHz of spectrum, 821-824 and 866-869 MHz, for public safety use. It is appropriate to use that same area here to define the New York Metropolitan Area. Table 1 lists the 31 counties of NPSPAC Region 8 with the 1990 population of each county.

State	County	Population, 1990[1]
CT	Fairfield	827,645
CT	Litchfield	174,092
CT	Middlesex	143,196
CT	New Haven	804,219
NJ	Bergen	825,380
NJ	Essex	778,206
NJ	Hudson	553,099
NJ	Hunterdon	107,776
NJ	Mercer	325,824
NJ	Middlesex	671,780
NJ	Monmouth	553,124
NJ	Morris	421,353
NJ	Passaic	453,060

State	County	Population, 1990[1]
NJ	Somerset	240,279
NJ	Sussex	130,943
NJ	Union	493,819
NJ	Warren	91,607
NY	Dutchess	259,462
NY	Nassau	1,287,348
NY	Orange	307,647
NY	Putnam	83,941
NY	Rockland	265,475
NY	Suffolk	1,321,864
NY	Sullivan	69,277
NY	Ulster	165,304
NY	Westchester	874,866
NYC	Bronx	1,203,789
NYC	Kings	2,300,664
NYC	New York	1,487,536
NYC	Queens	1,951,598
NYC	Richmond	348,977
	Total =	**19,523,150**

TABLE 1 - NPSPAC Region 8

The metro region was studied in two distinctly different ways. First, the 26 counties outside of New York City proper were studied by interviewing key people and collecting data regarding population, population density, personnel reports and the like. New York City, on the other hand, was broken down into the various agencies within city government and their populations. The sum of the two parts was the overall population, POP, for the New York Metropolitan Area.

II. OVERALL POPULATION

The first item to be determined was a forecast of the overall population of the region in the year 2010. A chart[2] was found which listed 30 of the 31 counties with population projections, by county, every five years out to the year 2020. The missing county was Middlesex county in Connecticut.

The values for the year 2010 were used in the following work. A projection for Middlesex county, CT was calculated using a growth similar to the other counties of Connecticut. The overall population of the region was forecast at 21,099,700 for the year 2010.

The next task was to search for a relationship between the total population and the number of public safety personnel. The following sections describe the findings.

III. POLICE OFFICER POPULATION

Each of the states annually publishes a crime report. Copies of the 1993 reports were obtained for New York[3] and New Jersey[4]. Contained within these reports are tables listing the number of police employees by town, county, etc. By using the number of sworn municipal and county police officers in each county and dividing by the population, a rate of police officers as a percent of overall population was determined.

Reference 1 contained population and land area statistics for each county. From these data the population density was calculated in population per square mile.

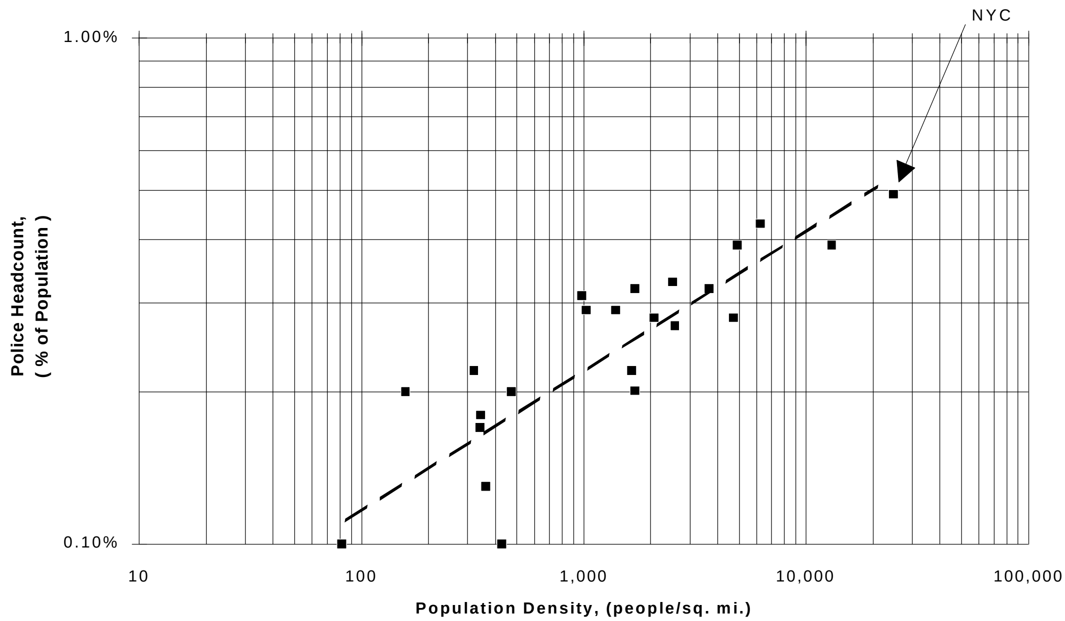

Figure 1 - Sworn Police Officer Rate vs. Population Density

Figure 1 shows that the rate of sworn police officers for a given area is directly proportional to the population density. New York City has 0.49% police at a population density of over 24,000 people/sq. mi, while Sullivan county has 0.1% police at a population density of 81 people/sq. mi. Values were then selected for the four counties of Connecticut by drawing a line through the data. The resulting values for Connecticut were in very close agreement with those received from the police frequency coordinator for the state.

Since the data above for New York and New Jersey did not include State Police functions of various kinds, a portion of the overall state police headcount was added, for New Jersey - based upon the percentage of the state geography included within NPSPAC Region 8 or 50.7% of the state, and for New York - based upon the distribution of personnel assigned within those NYS counties in Region 8.

The sworn police officer population projections for NPSPAC Region 8 are shown in exhibit 2 attached in column I. The grand total of sworn police officers is about 83,000.

IV. FIRE FIGHTER POPULATION

Outside of the City of New York the fire fighting community is made up largely of volunteer fire companies. The population values for fire fighters was determined in three ways. First, interviews were conducted in Bergen, Rockland, Westchester and Suffolk counties during which the number of volunteers and paid personnel were estimated for the entire county. Second, for Nassau county the county *Fire and EMS Data Book*[5] was used to sum the personnel for the entire county. Third, for the city of New York the *1994-95 Green Book*[6] listed the Fire Department at 12,421 personnel. In each of these six instances the current headcount was calculated as a percent of the current population. Then, this percentage was applied to the projected 2010 overall population in order to arrive at the projected population in 2010. Figure 2 is a plot of the data for these six instances.

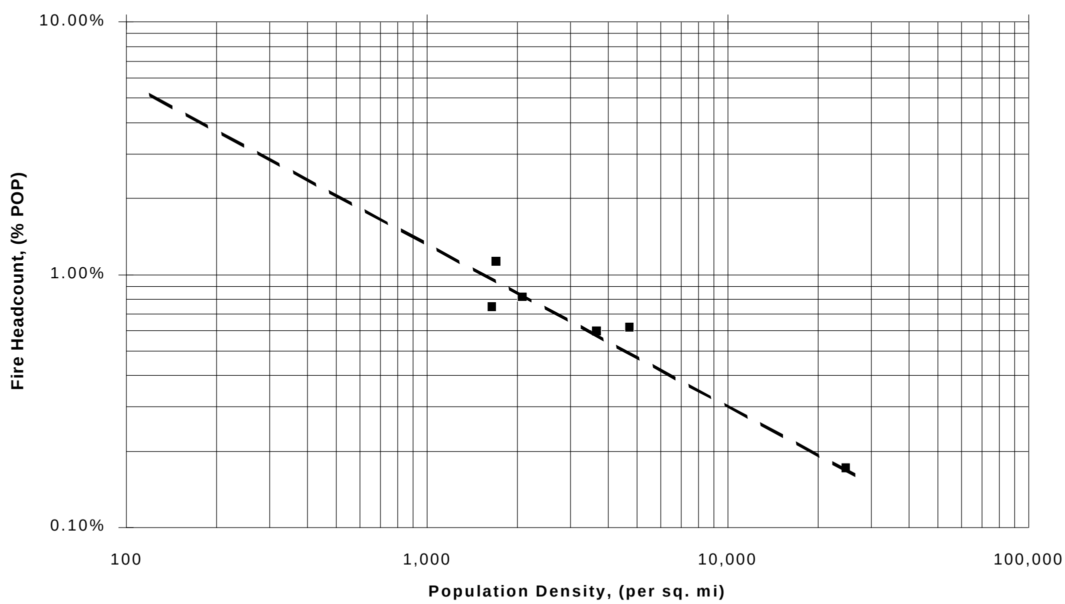

Figure 2 - Fire Fighter Rate vs. Population Density

Note that the slope of the line through these data is the opposite of the data for police. This is because in the case of fire fighters the more rural an area is, the more volunteer fire fighters there are (as a % of population). New York City, with 24,000 people per square mile has a fire fighter rate of 0.17% of population, while Rockland county has 1,700 people per square mile and 1.13% of population as fire fighters. A line was drawn through these six data points, and fire rates were determined for the other counties in that matter. Once the fire rate was established, it was applied to the 2010 population projection in order to determine the number of fire fighters in the year 2010.

The number of fire fighters projected in the year 2010 is shown in exhibit 2 attached at column K. The total for NPSPAC Region 8 is about 153,000.

V. EMERGENCY MEDICAL POPULATION

Emergency medical population was determined in the same manner as fire fighters. That is, through a process of interviews with key people in each of several counties and the City of New York. The Nassau County *Fire and EMS Data Book*, reference 5, was a valuable source of data which was used to check the sanity of the values determined through the interviews. Figure 3 is the plot of the data for the six samples.

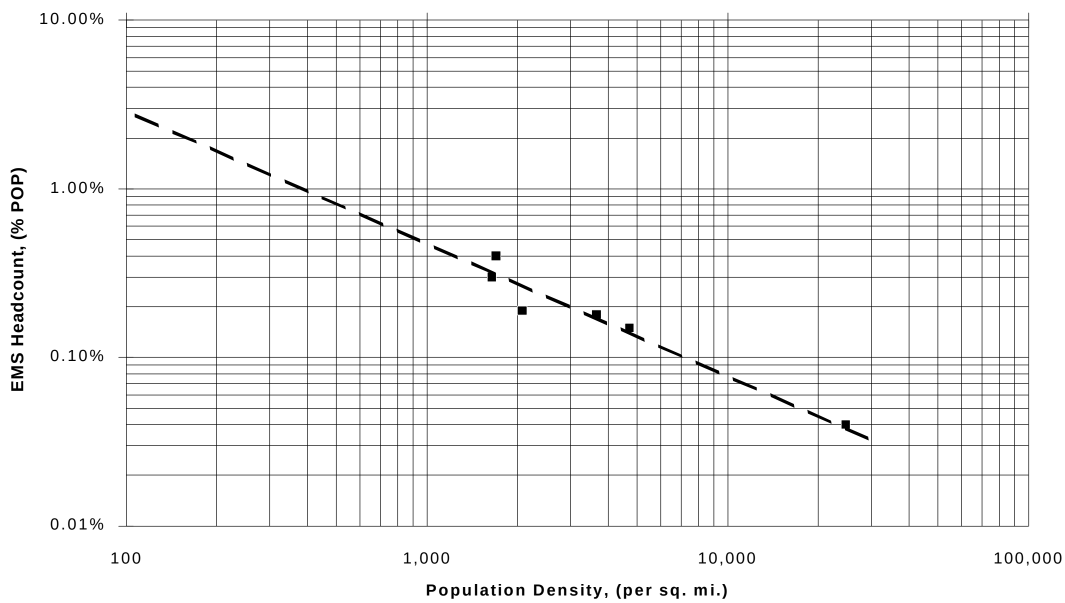

Figure 3 - EMS Headcount vs. Overall Population Density

The number of EMS personnel projected in the year 2010 is shown in exhibit 2 attached at column M. The total for NPSPAC Region 8 is about 52,000.

VI. GOVERNMENTAL SERVICES POPULATION

The police, fire, and emergency medical services populations within this report generally are considered the “first response” personnel within NPSPAC Region 8 and data on these services is more readily available than those of general (local) government, highway maintenance, forestry/conservation, public mass transportation, and correctional services.

These other governmental services have been combined for purposes of this report. The data presented for these services have been combined to simplify the presentation of the region’s requirements and not to diminish their respective importance.

The governmental service population values for 1995 for the counties **within the City of New York** are taken from the *1994-1995 Green Book*, reference 6. The various agencies of city government are listed with their staffing. The listing was studied and those agencies which are candidates for wireless communications were added to the attached exhibit 2 in column N. These 1995 values were summed and a growth rate applied to project the POP for the year 2010. The number of New York City governmental service employees (less the “first responders”) who are candidates for wireless communications is shown in attached exhibit 2 in column P at row 72. The total is about 149,000.

The governmental service population values for counties **outside of the City of New York** are calculated based on the following regional observations and relationships:

- The wireless needs of the general governmental users represents roughly half of the full-time employed “first response” personnel.
- Greater than 90% of the fire and emergency medical services are community based volunteer services.
- Regional Fire/EMS coordinators estimate that four volunteers in each of the respective services are equivalent to one full-time employee in that service.

Based on the above, the governmental services population rate for areas outside of the City of New York can be expressed as:

government population rate = 0.5 [police rate + 0.25(fire rate + EMS rate)]

This empirical formula is applied for all counties within NPSPAC Region 8 outside of the City of New York. The margin of error of this formula may not be significant when compared to the number of employees of the City of New York.

The staffing levels for several of the other large government run agencies such as, NYC Transit Authority[7], Metro North RR, Long Island RR, New Jersey Transit, and the Port Authority of NY and NJ, were added to exhibit 2 at rows 75 through 79.

The number of local government employees who are candidates for wireless communications are shown in attached exhibit 2 in column P. The grand total for Governmental Services is about 251,000.

VII. GRAND TOTAL

The grand total state and local public safety population for the New York Metropolitan Area was determined to be forecast in the year 2010 at 539,222.

For comparison purposes, the following attributes identify the New York Metropolitan Area.

- Includes portions of three (3) states
- Estimated area population in the year 2010 = 21,099,700
- Total land area = 12,369 square miles
- Average population density of the total area = 1,706 persons / square mile.

EXHIBIT 1 - POPULATION PROJECTIONS BY COUNTY (000)

NEW YORK METROPOLITAN TRANSPORTATION COUNCIL - 9/20/95

(PREPARED BY URBANOMICS - LAST REVISION 9/18/95)

	1970	1980	1990	1994	1995	2000	2005	2010	2015	2020
BRONX	1,471.7	1,169.0	1,203.8	1,191.3	1,192.6	1,203.8	1,223.4	1,240.3	1,260.0	1,289.8
KINGS	2,602.0	2,231.0	2,300.7	2,271.0	2,275.7	2,285.5	2,300.8	2,333.7	2,370.0	2,412.4
NEW YORK	1,539.2	1,428.3	1,487.5	1,506.4	1,510.0	1,520.4	1,540.8	1,556.7	1,565.2	1,575.0
QUEENS	1,986.5	1,891.3	1,951.6	1,964.3	1,970.3	1,999.0	2,029.4	2,062.4	2,124.0	2,189.2
RICHMOND	295.4	352.0	379.0	397.7	400.0	413.7	428.4	441.5	455.0	475.0
NEW YORK CITY	7,894.8	7,071.6	7,322.6	7,330.7	7,348.6	7,422.4	7,522.8	7,634.6	7,774.2	7,941.4
NASSAU	1,428.1	1,321.6	1,287.3	1,302.3	1,302.3	1,318.8	1,329.6	1,349.8	1,379.9	1,433.6
SUFFOLK	1,125.0	1,284.2	1,321.9	1,349.2	1,347.1	1,367.3	1,423.3	1,495.2	1,571.0	1,658.1
LONG ISLAND	2,553.0	2,605.8	2,609.2	2,651.5	2,549.4	2,686.1	2,752.9	2,845.0	2,950.9	3,091.7
DUTCHESS	222.3	245.1	259.5	261.5	259.8	263.6	278.4	289.9	301.1	315.6
ORANGE	221.7	259.6	307.6	320.5	319.5	336.9	361.5	384.7	407.1	431.5
PUTNAM	56.7	77.2	83.9	89.2	89.2	91.8	95.2	98.8	102.3	106.3
ROCKLAND	229.9	259.5	265.5	274.8	274.8	280.0	286.9	295.5	305.3	315.0
SULLIVAN	52.6	65.2	69.3	70.6	70.0	71.0	74.9	79.0	83.2	87.7
ULSTER	141.2	158.2	165.3	168.9	165.9	169.2	173.1	177.1	186.6	200.1
WESTCHESTER	894.1	866.6	874.9	888,8	885,6	891.0	892.9	897.7	900.0	905.0
MID-HUDSON	1,818.5	1,931.3	2,026.0	2,074.3	2,064.6	2,103.5	2,162.9	2,222.7	2,285.6	2,361.2
NEW YORK SUBURBS	4,371.5	4,537.1	4,635.2	4,725.8	4,714.2	4,789.6	4,915.8	5,067.7	5,236.5	5,452.9
NEW YORK METRO	12,266.3	11,608.7	11,957.8	12,056.5	12,062.8	12,212.0	12,438.6	12,702.3	13,010.7	13,394.3
BERGEN	898.0	845.4	825.4	842.4	846.9	847.6	851.2	857.3	858.9	859.2
ESSEX	930.0	851.3	778.2	765.4	770.1	777.8	782.2	782.4	779.9	779.7
HUDSON	609.3	557.0	553.1	552.4	556.0	567.9	588.1	612.5	638.4	652.1
HUNTERDON	69.7	87.4	107.8	115.2	117.9	127.3	136.8	146.4	158.0	165.6
MERCER	304.0	307.9	325.8	329.4	330.8	343.5	361.3	383.1	400.4	411.7
MIDDLESEX	583.3	595.9	671.8	692.9	701.5	729.6	763.9	797.5	838.8	889.6
MONMOUTH	459.4	503.2	553.1	578.5	586.6	601.6	633.1	656.6	680.1	703.6
MORRIS	383.5	407.6	421.4	438.5	445.5	460.4	460.4	460.5	465.2	475.2
OCEAN	208.5	346.0	433.2	456.5	466.5	508.5	559.9	606.9	653.9	703.5
PASSAIC	460.8	447.6	453.1	461.8	463.8	463.6	463.5	463.4	463.3	453.2
SOMERSET	198.4	203.1	240.3	260.7	267.7	288.7	292.0	312.3	348.6	371.1
SUSSEX	77.5	116.1	130.9	138.3	140.6	149.7	157.6	167.2	178.1	185.2
UNION	543.1	504.1	493.8	496.2	499.0	502.0	502.5	503.8	515.5	523.1
WARREN	73.9	84.4	91.6	95.4	96.7	106.3	115.0	122.9	131.2	140.8
NEW JERSEY	5,799.7	5,857.0	6,079.5	6,223.6	6,289.6	6,474.5	6,667.5	6,872.8	7,108.3	7,323.6
FAIRFIELD	792.8	807.1	827.6	829.8	838.4	846.6	877.8	906.3	945.5	978.1
LITCHFIELD	144.1	156.8	174.1	178.5	181.0	190.6	200.4	211.6	223.2	241.0
NEW HAVEN	744.9	761.3	804.2	796.5	807.6	823.3	839.2	857.5	876.3	903.7
CONNECTICUT	1,681.9	1,725.2	1,806.0	1,804.8	1,827.0	1,860.5	1,917.4	1,975.4	2,045.0	2,122.8
REGION	19,747.9	19,190.9	19,843.2	20,084.9	20,179.4	20,547.0	21,023.5	21,550.5	22,164.0	22,840.7

EXHIBIT 2 DEMOGRAPHIC DATA

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
2	State	County	1990 POP	2010 POP	Area, s.m.	2010 p/sm	Police Rate	2010 POL	Fire Rate	2010 FIRE	EMS Rate	2010 EMS	1995 NYC	Rate	2010 GOV
	----	----------------------------	------------	------------	------------	-------------	------------	------------	----------	------------	------------	------------	------------	------	-----------
3	CT	Fairfield	827,645	906,300	626	1,448	0.30%	2,719	1.00%	9,063	0.35%	3,172		0.32%	2,889
4	CT	Litchfield	174,092	211,600										920	230
											0.17%	360	3.30%	6,983	1.50%
											3,174		0.69%	1,449	
5	CT	Middlesex	143,196	156,100	369	423	0.20%	312	2.20%	3,434	0.90%	1,405		0.49%	761
6	CT	New Haven	804,219	857,500	606	1,415	0.30%	2,573	1.00%	8,575	0.32%	2,744		0.32%	2,701
7															
8	NJ	Bergen	825,380	857,300	234	3,664	0.32%	2,743	0.58%	4,972	0.18%	1,543		0.26%	2,186
9	NJ	Essex	778,206	782,400	126	6,210	0.43%	3,364	0.40%	3,130	0.11%	861		0.28%	2,181
10	NJ	Hudson	553,099	612,500	47	13,032	0.39%	2,389	0.23%	1,409	0.06%	367		0.23%	1,416
11	NJ	Hunterdon	107,776	146,400	430	340	0.17%	249	2.50%	3,660	1.10%	1,610		0.54%	783
12	NJ	Mercer	325,824	383,100	226	1,695	0.32%	1,226	0.90%	3,448	0.30%	1,149		0.31%	1,188
13	NJ	Middlesex	671,780	797,500	311	2,564	0.27%	2,153	0.70%	5,583	0.23%	1,834		0.25%	2,004
14	NJ	Monmouth	553,124	656,600	472	1,391	0.29%	1,904	1.00%	6,566	0.25%	1,642		0.30%	1,978
15	NJ	Morris	421,353	460,500	469	982	0.31%	1,428	1.30%	5,987	0.48%	2,210		0.38%	1,738
16	NJ	Passaic	453,060	463,400	185	2,505	0.33%	1,529	0.70%	3,244	0.22%	1,019		0.28%	1,298
17	NJ	Somerset	240,279	312,300	305	1,024	0.29%	906	1.30%	4,060	0.45%	1,405		0.36%	1,136
18	NJ	Sussex	130,943	167,200	521	321	0.22%	368	2.70%	4,514	1.10%	1,839		0.59%	978
19	NJ	Union	493,819	503,800	103	4,891	0.39%	1,965	0.47%	2,368	0.13%	655		0.27%	1,360
20	NJ	Warren	91,607	122,900	358	343	0.18%	221	2.50%	3,073	1.00%	1,229		0.53%	648
21	NJ	New Jersey State Police (50.7%)						1,467							
22	NJ	Dept of Corrections (50.7%)						3,147							
23	NJ	Other Police (50.7%)						363							
24															
25	NY	Dutchess	259,462	289,900	802	361	0.13%	377	2.50%	7,248	1.00%	2,899		0.50%	1,457
26	NY	Nassau	1,287,348	1,349,800	287	4,703	0.28%	3,779	0.50%	6,749	0.13%	1,755		0.22%	2,953
27	NY	Orange	307,647	384,700	816	471	0.20%	769	2.10%	8,079	0.85%	3,270		0.47%	1,803
28	NY	Putnam	83,941	98,800	232	426	0.10%	99	2.20%	2,174	0.90%	889		0.44%	432
29	NY	Rockland	265,475	295,500	174	1,698	0.20%	594	0.90%	2,660	0.30%	887		0.25%	740
30	NY	Suffolk	1,321,864	1,495,200	911	1,641	0.22%	3,289	0.95%	14,204	0.30%	4,486		0.27%	3,981
31	NY	Sullivan	69,277	79,000	970	81	0.10%	79	6.00%	4,740	3.00%	2,370		1.18%	928
32	NY	Ulster	165,304	177,100	1,127	157	0.20%	354	4.00%	7,084	2.00%	3,542		0.85%	1,505
33	NY	Westchester	874,866	897,700	433	2,073	0.28%	2,514	0.80%	7,182	0.10%	898		0.25%	2,267
34	NY	NY State Police						877							
35	NY	Other PD's (Campus, Parks, etc)						250							
36															
37															
38															
39	NYC	Bronx	1,203,789	1,240,300	42	29,531									
40	NYC	Kings	2,300,664	2,333,700	71	32,869									
41	NYC	New York	1,487,536	1,556,700	28	55,596									
42	NYC	Queens	1,951,598	2,062,400	109	18,921									
43	NYC	Richmond	348,977	441,500	59	7,483									
44		AGENCY													
45		Aging, Dept for the											288		
46		Borough President (5 boros)											506		
47		Buildings, Dept of											605		
48	NYC	City Sheriff											452		
49		City University											3,587		
50		Consumer Affairs, Dept of											252		
51	NYC	Dept. of Corrections											12,342		
52	NYC	Bronx District Attorney											706		
53	NYC	Kings District Attorney											1,106		
54	NYC	New York DA											1,140		
55	NYC	Queens DA											561		
56	NYC	Richmond DA											96		
57	NYC	Board of Education											87,346		
58	NYC	DEP											6,029		
59	NYC	Dept of Health											2,600		
60		Housing, Pres & Dev, Dept of											3,557		
61	NYC	DOITT											318		
62		Investigation, Dept of											345		
63	NYC	Mayoralty											1,182		
64	NYC	Mental Health Svcs											268		
65	NYC	Prosecution-Specal Narcotics											233		
66	NYC	Parks & Recreation											2,548		
67	NYC	Office of Probation											1,636		
68	NYC	Dept of Sanitation											8,832		
69	NYC	Taxi & Limousine Commission											463		
70	NYC	Dept of Transportation											6,125		
71	NYC	Youth Services, Dept of											145		
72	NYC	Total City	7,292,564	7,634,600	309	24,707	0.49%	37,562	0.17%	13,132	0.04%	3,054	141,869	1.95%	148,523
73															
74															
75	NYC	NYCTransit Authority											46,000	0.64%	48,861
76		Metro North						200					5,300	0.07%	5,344
77		Port Authority of NY & NJ						700							
78		Long Island Railroad						250					1,950	?	1,950
79		New Jersey Transit						150					3,700	?	3,700
80		TOTAL	19,523,150	21,099,700	12,369	1,706		83,229		153,317		51,909			251,140
81															
82											GRAND TOTAL P.S. POP. IN 2010 - 539,595				

PSWAC Operational Requirements - Appendix B-2-A
New York Metro Region Operational Needs
Report On Penetration (PEN)

This section is a companion to the section, Appendix B-1-A, state and local public safety population (POP) for the 31 county, New York Metropolitan Area - FCC Public Safety Region 8. In that section on population, the New York Metro Region was defined and population values were determined for each county in the region, the various agencies of New York City and certain state agencies.

Certain key agencies were interviewed to determine the percentage of the user category population (penetration) that would require a particular category of communication service offering. In order to complete this task in the time available, the other governmental entities in the study area were compared to the interviewed agencies for similar operational attributes and penetration data assigned accordingly.

This section on penetration, Appendix B-2-A, uses the population data projected for the year 2010 from Appendix B-1-A. Eight spreadsheet pages each list the data for one of the eight categories of communication service offerings. For each row in a worksheet, the four user categories of Police, Fire, EMS and General Government are listed. For each user category, the population is listed along with its penetration. The penetrated population (population x penetration) is then summed for each user category. This sum, divided by total population, yields the weighted penetration for that user category and communication service offering.

The eight categories of communication service offerings are:

1. Voice Dispatch
2. Voice Interconnect
3. Transaction Processing
4. Facsimile
5. Snapshot (visual image)
6. Remote File Access/Decision Processing
7. Slow Scan Video
8. Full Motion Video

These eight categories of communication service offerings agree with those defined in the PSWAC model for prediction of spectrum need.

The four categories of users are:

1. Police
2. Fire
3. Emergency Medical Service
4. General Government

The results are shown on the attached spreadsheets.

PENETRATION DATA - VOICE DISPATCH

	County/ Agency	POLICE 2010	VX DISP PEN %	PERSNL PEN	FIRE 2010	VX DISP PEN %	PERSNL PEN	EMS 2010	VX DISP PEN %	PERSNL PEN	GOV. SVCS 2010	VX DISP PEN %	PERSNL PEN %
CT	FAIRFIELD	2,719	50.00%	1,360	9,063	15.00%	1,359	3,172	20.00%	634	2,889		0
CT	LITCHFIELD	360	50.00%	180	6,983	50.00%	3,492	3,174	40.00%	1,270	1,449		0
CT	MIDDLESEX	312	50.00%	156	3,434	50.00%	1,717	1,405	40.00%	562	761		0
CT	NEW HAVEN	2,573	50.00%	1,287	8,575	15.00%	1,286	2,744	20.00%	549	2,701		0
NJ	BERGEN	2,743	40.00%	1,097	4,972	50.00%	2,486	1,543	40.00%	617	2,186	50.00%	1,093
NJ	ESSEX	3,364	50.00%	1,682	3,130	50.00%	1,565	861	50.00%	431	2,181		0
NJ	HUDSON	2,389	50.00%	1,195	1,409	50.00%	705	368	50.00%	184	1,416		0
NJ	HUNTERDON	249	50.00%	125	3,660	50.00%	1,830	1,610	40.00%	644	783		0
NJ	MERCER	1,226	50.00%	613	3,448	15.00%	517	1,149	20.00%	230	1,188		0
NJ	MIDDLESEX	2,153	40.00%	861	5,583	50.00%	2,792	1,834	40.00%	734	2,004	50.00%	1,002
NJ	MONMOUTH	1,904	40.00%	762	6,566	50.00%	3,283	1,642	40.00%	657	1,978	50.00%	989
NJ	MORRIS	1,428	40.00%	571	5,987	50.00%	2,994	2,210	40.00%	884	1,738	50.00%	869
NJ	PASSAIC	1,529	50.00%	765	3,244	50.00%	1,622	1,019	50.00%	510	1,298		0
NJ	SOMERSET	906	50.00%	453	4,060	50.00%	2,030	1,405	40.00%	562	1,136		0
NJ	SUSSEX	368	50.00%	184	4,514	50.00%	2,257	1,839	40.00%	736	978		0
NJ	UNION	1,965	50.00%	983	2,368	50.00%	1,184	655	50.00%	328	1,360		0
NJ	WARREN	221	50.00%	111	3,073	50.00%	1,537	1,229	40.00%	492	648		0
NJ	NJ STATE POLICE	1,467	50.00%	734									
NJ	NJ DEPT. CORRECT.	3,147	50.00%	1,574									
NJ	NJ OTHER POLICE	363	50.00%	182									
NY	DUTCHESS	377	50.00%	189	7,248	50.00%	3,624	2,899	40.00%	1,160	1,457		0
NY	NASSAU	3,779	50.00%	1,890	6,749	15.00%	1,012	1,755	20.00%	351	2,953		0
NY	ORANGE	769	50.00%	385	8,079	50.00%	4,040	3,270	40.00%	1,308	1,803		0
NY	PUTNAM	99	50.00%	50	2,174	50.00%	1,087	889	40.00%	356	432		0
NY	ROCKLAND	594	50.00%	297	2,660	50.00%	1,330	887	40.00%	355	740		0

	County/ Agency	POLICE 2010	VX DISP PEN %	PERSNL PEN	FIRE 2010	VX DISP PEN %	PERSNL PEN	EMS 2010	VX DISP PEN %	PERSNL PEN	GOV. SVCS 2010	VX DISP PEN %	PERSNL PEN %
NY	SUFFOLK	3,289	36.00%	1,184	14,204	15.00%	2,131	4,486	20.00%	897	3,981		0
NY	SULLIVAN	79	50.00%	40	4,740	50.00%	2,370	2,370	40.00%	948	928		0
NY	ULSTER	354	50.00%	177	7,084	50.00%	3,542	3,542	40.00%	1,417	1,505		0
NY	WESTCHESTER	2,514	50.00%	1,257	7,182	15.00%	1,077	898	20.00%	180	2,267		0
NY	NY STATE POLICE	877	40.00%	351									
NY	NY OTHER POLICE	250	50.00%	125									
NY	NEW YORK CITY	37,562	60.00%	22,537	13,132	60.00%	7,879	3,054	50.00%	1,527	148,523	15.00%	22,278
	BRONX												
	KINGS												
	NEW YORK												
	QUEENS												
	RICHMOND												
NY	METRO TRANSIT AUTH										48,861	43.00%	21,010
	METRO NORTH RR	200	50.00%	100							5,344	43.00%	2,298
	PORT AUTH NY NJ	700	80.00%	560									
	LONG ISLAND RR	250	50.00%	125							1,950	43.00%	839
	NJ TRANSIT	150	50.00%	75							3,700	43.00%	1,591
	TOTALS	**83,229**		**44,210**	**153,321**		**60,746**	**51,909**		**18,519**	**251,138**		**51,969**
	PENETR.BY CATEGORY	**53.12%**			**39.62%**			**35.67%**			**20.69%**		

PENETRATION DATE - VOICE INTERCONNECT

	County / Agency	POLICE 2010	VX INTRC PEN %	PERSNL PEN	FIRE 2010	VX INTRC PEN %	PERSNL PEN	EMS 2010	VX INTRC PEN %	PERSNL PEN	GOV SVCS 2010	VX INTRC PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	20.00%	544	9,063	7.00%	634	3,172	20.00%	634	2,889		0
CT	LITCHFIELD	360	20.00%	72	6,983	20.00%	1,397	3,174	10.00%	317	1,449		0
CT	MIDDLESEX	312	20.00%	62	3,434	20.00%	687	1,405	10.00%	141	761		0
CT	NEW HAVEN	2,573	20.00%	515	8,575	7.00%	600	2,744	20.00%	549	2,701		0
NJ	BERGEN	2,743	0.00%	0	4,972	0.00%	0	1,543	0.00%	0	2,186		0
NJ	ESSEX	3,364	10.00%	336	3,130	10.00%	313	861	10.00%	86	2,181		0
NJ	HUDSON	2,389	10.00%	239	1,409	10.00%	141	368	10.00%	37	1,416		0
NJ	HUNTERDON	249	20.00%	50	3,660	20.00%	732	1,610	10.00%	161	783		0
NJ	MERCER	1,226	20.00%	245	3,448	7.00%	241	1,149	20.00%	230	1,188		0
NJ	MIDDLESEX	2,153	0.00%	0	5,583	0.00%	0	1,834	0.00%	0	2,004		0
NJ	MONMOUTH	1,904	0.00%	0	6,566	0.00%	0	1,642	0.00%	0	1,978		0
NJ	MORRIS	1,428	0.00%	0	5,987	0.00%	0	2,210	0.00%	0	1,738		0
NJ	PASSAIC	1,529	10.00%	153	3,244	10.00%	324	1,019	10.00%	102	1,298		0
NJ	SOMERSET	906	20.00%	181	4,060	20.00%	812	1,405	10.00%	141	1,136		0
NJ	SUSSEX	368	20.00%	74	4,514	20.00%	903	1,839	10.00%	184	978		0
NJ	UNION	1,965	10.00%	197	2,368	10.00%	237	655	10.00%	66	1,360		0
NJ	WARREN	221	20.00%	44	3,073	20.00%	615	1,229	10.00%	123	648		0
NJ	NJ STATE POLICE	1,467	20.00%	293			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	20.00%	629			0			0			0
NJ	NJ OTHER POLICE	363	20.00%	73			0			0			0
NY	DUTCHESS	377	20.00%	75	7,248	20.00%	1,450	2,899	10.00%	290	1,457		0
NY	NASSAU	3,779	20.00%	756	6,749	7.00%	472	1,755	20.00%	351	2,953		0
NY	ORANGE	769	20.00%	154	8,079	20.00%	1,616	3,270	10.00%	327	1,803		0
NY	PUTNAM	99	20.00%	20	2,174	20.00%	435	889	10.00%	89	432		0
NY	ROCKLAND	594	20.00%	119	2,660	20.00%	532	887	10.00%	89	740		0
NY	SUFFOLK	3,289	5.00%	164	14,204	7.00%	994	4,486	20.00%	897	3,981		0

	County / Agency	POLICE 2010	VX INTRC PEN %	PERSNL PEN	FIRE 2010	VX INTRC PEN %	PERSNL PEN	EMS 2010	VX INTRC PEN %	PERSNL PEN	GOV SVCS 2010	VX INTRC PEN %	PERSNL PEN
NY	SULLIVAN	79	20.00%	16	4,740	20.00%	948	2,370	10.00%	237	928		0
NY	ULSTER	354	20.00%	71	7,084	20.00%	1,417	3,542	10.00%	354	1,505		0
NY	WEST-CHESTER	2,514	20.00%	503	7,182	7.00%	503	898	20.00%	180	2,267		0
NY	NY STATE POLICE	877	20.00%	175			0			0			0
NY	NY OTHER POLICE	250	20.00%	50			0			0			0
NY	NEW YORK CITY	37,562	10.00%	3,756	13,132	10.00%	1,313	3,054	10.00%	305	148,523	2.00%	2,970
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	0.43%	210
	METRO NORTH RR	200	0.43%	1			0			0	5,344	0.43%	23
	PORT AUTH NY NJ	700	10.00%	70			0			0			0
	LONG ISLAND RR	250	0.43%	1			0			0	1,950	0.43%	8
	NJ TRANSIT	150	0.43%	1			0			0	3,700	0.43%	16
	TOTALS	**83,229**		**9,639**	**153,321**		**17,316**	**51,909**		**5,888**	**251,138**		**3,228**
	PENETR. BY CATEGORY	**11.58%**			**11.29%**			**11.34%**			**1.29%**		

PENETRATION DATA - TRANSACTION PROCESSING

	County / Agency	POLICE 2010	TRNS/ PRC PEN %	PERSNL PEN	FIRE 2010	TRNS/ PRC PEN %	PERSNL PEN	EMS 2010	TRNS/ PRC PEN %	PERSNL PEN	GOV SVCS 2010	TRNS/ PRC PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	50.00%	1,360	9,063	7.00%	634	3,172	20.00%	634	2,889		0
CT	LITCHFIELD	360	50.00%	180	6,983	50.00%	3,492	3,174	40.00%	1,270	1,449		0
CT	MIDDLESEX	312	50.00%	156	3,434	50.00%	1,717	1,405	40.00%	562	761		0
CT	NEW HAVEN	2,573	50.00%	1,287	8,575	7.00%	600	2,744	20.00%	549	2,701		0
NJ	BERGEN	2,743	40.00%	1,097	4,972	40.00%	1,989	1,543	40.00%	617	2,186	low	0
NJ	ESSEX	3,364	50.00%	1,682	3,130	50.00%	1,565	861	50.00%	431	2,181		0
NJ	HUDSON	2,389	50.00%	1,195	1,409	50.00%	705	368	50.00%	184	1,416		0
NJ	HUNTERDON	249	50.00%	125	3,660	50.00%	1,830	1,610	40.00%	644	783		0
NJ	MERCER	1,226	50.00%	613	3,448	7.00%	241	1,149	20.00%	230	1,188		0
NJ	MIDDLESEX	2,153	40.00%	861	5,583	40.00%	2,233	1,834	40.00%	734	2,004	low	0
NJ	MONMOUTH	1,904	40.00%	762	6,566	40.00%	2,626	1,642	40.00%	657	1,978	low	0
NJ	MORRIS	1,428	40.00%	571	5,987	40.00%	2,395	2,210	40.00%	884	1,738	low	0
NJ	PASSAIC	1,529	50.00%	765	3,244	50.00%	1,622	1,019	50.00%	510	1,298		0
NJ	SOMERSET	906	50.00%	453	4,060	50.00%	2,030	1,405	40.00%	562	1,136		0
NJ	SUSSEX	368	50.00%	184	4,514	50.00%	2,257	1,839	40.00%	736	978		0
NJ	UNION	1,965	50.00%	983	2,368	50.00%	1,184	655	50.00%	328	1,360		0
NJ	WARREN	221	50.00%	111	3,073	50.00%	1,537	1,229	40.00%	492	648		0
NJ	NJ STATE POLICE	1,467	50.00%	734			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	50.00%	1,574			0			0			0
NJ	NJ OTHER POLICE	363	50.00%	182			0			0			0
NY	DUTCHESS	377	50.00%	189	7,248	50.00%	3,624	2,899	40.00%	1,160	1,457		0
NY	NASSAU	3,779	50.00%	1,890	6,749	7.00%	472	1,755	20.00%	351	2,953		0
NY	ORANGE	769	50.00%	385	8,079	50.00%	4,040	3,270	40.00%	1,308	1,803		0
NY	PUTNAM	99	50.00%	50	2,174	50.00%	1,087	889	40.00%	356	432		0
NY	ROCKLAND	594	50.00%	297	2,660	50.00%	1,330	887	40.00%	355	740		0
NY	SUFFOLK	3,289	30.00%	987	14,204	7.00%	994	4,486	20.00%	897	3,981		0

	County / Agency	POLICE 2010	TRNS/ PRC PEN %	PERSNL PEN	FIRE 2010	TRNS/ PRC PEN %	PERSNL PEN	EMS 2010	TRNS/ PRC PEN %	PERSNL PEN	GOV SVCS 2010	TRNS/ PRC PEN %	PERSNL PEN
NY	SULLIVAN	79	50.00%	40	4,740	50.00%	2,370	2,370	40.00%	948	928		0
NY	ULSTER	354	50.00%	177	7,084	50.00%	3,542	3,542	40.00%	1,417	1,505		0
NY	WESTCHESTER	2,514	50.00%	1,257	7,182	7.00%	503	898	20.00%	180	2,267		0
NY	NY STATE POLICE	877	50.00%	439			0			0			0
NY	NY OTHER POLICE	250	50.00%	125			0			0			0
NY	NEW YORK CITY	37,562	12.50%	4,695	13,132	12.50%	1,642	3,054	25.00%	764	148,523	10.00%	14,852
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	43.00%	21,010
	METRO NORTH RR	200	43.00%	86			0			0	5,344	43.00%	2,298
	PORT AUTH NY NJ	700	50.00%	350			0			0			0
	LONG ISLAND RR	250	43.00%	108			0			0	1,950	43.00%	839
	NJ TRANSIT	150	43.00%	65			0			0	3,700	43.00%	1,591
	TOTALS	**83,229**		**26,006**	**153,321**		**48,260**	**51,909**		**17,755**	**251,138**		**40,590**
	PENETR. BY CATEGORY	**31.25%**			**31.48%**			**34.20 %**			**16.16%**		

PENETRATION DATA - FACSIMILE

	County / Agency	POLICE 2010	FAX PEN %	PERSNL PEN	FIRE 2010	FAX PEN %	PERSNL PEN	EMS 2010	FAX PEN %	PERSNL PEN	GOV SVCS 2010	FAX PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	10.00%	272	9,063	7.00%	634	3,172	20.00%	634	2,889		0
CT	LITCHFIELD	360	1.00%	4	6,983	20.00%	1,397	3,174	10.00%	317	1,449		0
CT	MIDDLESEX	312	1.00%	3	3,434	20.00%	687	1,405	10.00%	141	761		0
CT	NEW HAVEN	2,573	10.00%	257	8,575	7.00%	600	2,744	20.00%	549	2,701		0
NJ	BERGEN	2,743	20.00%	549	4,972	low	0	1,543	20.00%	309	2,186	low	0
NJ	ESSEX	3,364	5.00%	168	3,130	5.00%	157	861	10.00%	86	2,181		0
NJ	HUDSON	2,389	5.00%	119	1,409	5.00%	70	368	10.00%	37	1,416		0
NJ	HUNTERDON	249	1.00%	2	3,660	20.00%	732	1,610	10.00%	161	783		0
NJ	MERCER	1,226	10.00%	123	3,448	7.00%	241	1,149	20.00%	230	1,188		0
NJ	MIDDLESEX	2,153	20.00%	431	5,583	low	0	1,834	20.00%	367	2,004	low	0
NJ	MONMOUTH	1,904	20.00%	381	6,566	low	0	1,642	20.00%	328	1,978	low	0
NJ	MORRIS	1,428	20.00%	286	5,987	low	0	2,210	20.00%	442	1,738	low	0
NJ	PASSAIC	1,529	5.00%	76	3,244	5.00%	162	1,019	10.00%	102	1,298		0
NJ	SOMERSET	906	1.00%	9	4,060	20.00%	812	1,405	10.00%	141	1,136		0
NJ	SUSSEX	368	1.00%	4	4,514	20.00%	903	1,839	10.00%	184	978		0
NJ	UNION	1,965	5.00%	98	2,368	5.00%	118	655	10.00%	66	1,360		0
NJ	WARREN	221	1.00%	2	3,073	20.00%	615	1,229	10.00%	123	648		0
NJ	NJ STATE POLICE	1,467	1.00%	15			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	1.00%	31			0			0			0
NJ	NJ OTHER POLICE	363	1.00%	4			0			0			0
NY	DUTCHESS	377	1.00%	4	7,248	20.00%	1,450	2,899	10.00%	290	1,457		0
NY	NASSAU	3,779	10.00%	378	6,749	7.00%	472	1,755	20.00%	351	2,953		0
NY	ORANGE	769	1.00%	8	8,079	20.00%	1,616	3,270	10.00%	327	1,803		0
NY	PUTNAM	99	1.00%	1	2,174	20.00%	435	889	10.00%	89	432		0

	County / Agency	POLICE 2010	FAX PEN %	PERSNL PEN	FIRE 2010	FAX PEN %	PERSNL PEN	EMS 2010	FAX PEN %	PERSNL PEN	GOV SVCS 2010	FAX PEN %	PERSNL PEN
NY	ROCKLAND	594	1.00%	6	2,660	20.00%	532	887	10.00%	89	740		0
NY	SUFFOLK	3,289	5.00%	164	14,204	7.00%	994	4,486	20.00%	897	3,981		0
NY	SULLIVAN	79	1.00%	1	4,740	20.00%	948	2,370	10.00%	237	928		0
NY	ULSTER	354	1.00%	4	7,084	20.00%	1,417	3,542	10.00%	354	1,505		0
NY	WEST-CHESTER	2,514	10.00%	251	7,182	7.00%	503	898	20.00%	180	2,267		0
NY	NY STATE POLICE	877	1.00%	9			0			0			0
NY	NY OTHER POLICE	250	1.00%	3			0			0			0
NY	NEW YORK CITY	37,562	5.00%	1,878	13,132	5.00%	657	3,054	10.00%	305	148,523	low	0
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	low	0
	METRO NORTH RR	200	1.00%	2			0			0	5,344	low	0
	PORT AUTH NY NJ	700	5.00%	35			0			0			0
	LONG ISLAND RR	250	1.00%	3			0			0	1,950	low	0
	NJ TRANSIT	150	1.00%	2			0			0	3,700	low	0
	TOTALS	**83,229**		**5,581**	**153,321**		**16,151**	**51,909**		**7,334**	**251,138**		**0**
	PENETR. BY CATEGORY	**6.71%**			**10.53%**			**14.13%**			**0.00%**		

PENETRATION DATA - SNAP SHOT (VISUAL IMAGE)

	County / Agency	POLICE 2010	SNP SHOT PEN %	PERSNL PEN	FIRE 2010	SNP SHOT PEN %	PERSNL PEN	EMS 2010	SNP SHOT PEN %	PERSNL PEN	GOV SVCS 2010	SNP SHOT PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	25.00%	680	9,063	3.00%	272	3,172	10.00%	317	2,889		0
CT	LITCHFIELD	360	50.00%	180	6,983	10.00%	698	3,174	40.00%	1,270	1,449		0
CT	MIDDLESEX	312	50.00%	156	3,434	10.00%	343	1,405	40.00%	562	761		0
CT	NEW HAVEN	2,573	25.00%	643	8,575	3.00%	257	2,744	10.00%	274	2,701		0
NJ	BERGEN	2,743	40.00%	1,097	4,972	40.00%	1,989	1,543	40.00%	617	2,186	very low	0
NJ	ESSEX	3,364	25.00%	841	3,130	40.00%	1,252	861	33.00%	284	2,181		0
NJ	HUDSON	2,389	25.00%	597	1,409	40.00%	564	368	33.00%	121	1,416		0
NJ	HUNTERDON	249	50.00%	125	3,660	10.00%	366	1,610	40.00%	644	783		0
NJ	MERCER	1,226	25.00%	307	3,448	3.00%	103	1,149	10.00%	115	1,188		0
NJ	MIDDLESEX	2,153	40.00%	861	5,583	40.00%	2,233	1,834	40.00%	734	2,004	very low	0
NJ	MONMOUTH	1,904	40.00%	762	6,566	40.00%	2,626	1,642	40.00%	657	1,978	very low	0
NJ	MORRIS	1,428	40.00%	571	5,987	40.00%	2,395	2,210	40.00%	884	1,738		0
NJ	PASSAIC	1,529	25.00%	382	3,244	40.00%	1,298	1,019	33.00%	336	1,298		0
NJ	SOMERSET	906	50.00%	453	4,060	10.00%	406	1,405	40.00%	562	1,136		0
NJ	SUSSEX	368	50.00%	184	4,514	10.00%	451	1,839	40.00%	736	978		0
NJ	UNION	1,965	25.00%	491	2,368	40.00%	947	655	33.00%	216	1,360		0
NJ	WARREN	221	50.00%	111	3,073	10.00%	307	1,229	40.00%	492	648		0
NJ	NJ STATE POLICE	1,467	50.00%	734			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	50.00%	1,574			0			0			0
NJ	NJ OTHER POLICE	363	50.00%	182			0			0			0
NY	DUTCHESS	377	50.00%	189	7,248	10.00%	725	2,899	40.00%	1,160	1,457		0
NY	NASSAU	3,779	25.00%	945	6,749	3.00%	202	1,755	10.00%	176	2,953		0
NY	ORANGE	769	50.00%	385	8,079	10.00%	808	3,270	40.00%	1,308	1,803		0
NY	PUTNAM	99	50.00%	50	2,174	10.00%	217	889	40.00%	356	432		0

	County / Agency	POLICE 2010	SNP SHOT PEN %	PERSNL PEN	FIRE 2010	SNP SHOT PEN %	PERSNL PEN	EMS 2010	SNP SHOT PEN %	PERSNL PEN	GOV SVCS 2010	SNP SHOT PEN %	PERSNL PEN
NY	ROCKLAND	594	50.00%	297	2,660	10.00%	266	887	40.00%	355	740		0
NY	SUFFOLK	3,289	5.00%	164	14,204	3.00%	426	4,486	10.00%	449	3,981		0
NY	SULLIVAN	79	50.00%	40	4,740	10.00%	474	2,370	40.00%	948	928		0
NY	ULSTER	354	50.00%	177	7,084	10.00%	708	3,542	40.00%	1,417	1,505		0
NY	WEST-CHESTER	2,514	25.00%	629	7,182	3.00%	215	898	10.00%	90	2,267		0
NY	NY STATE POLICE	877	50.00%	439			0			0			0
NY	NY OTHER POLICE	250	50.00%	125			0			0			0
NY	NEW YORK CITY	37,562	25.00%	9,391	13,132	40.00%	5,253	3,054	33.00%	1,008	148,523	0.50%	743
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	2.00%	977
	METRO NORTH RR	200	5.00%	10			0			0	5,344	0.50%	27
	PORT AUTH NY NJ	700	25.00%	175			0			0			0
	LONG ISLAND RR	250	5.00%	13			0			0	1,950	0.50%	10
	NJ TRANSIT	150	5.00%	8			0			0	3,700	0.50%	19
	TOTALS	**83,229**		**23,962**	**153,321**		**25,804**	**51,909**		**16,085**	**251,138**		**1,775**
	PENETR. BY CATEGORY	**28.79%**			**16.83%**			**30.99%**			**0.71%**		

PENETRATION DATA - REMOTE FILE ACCESS/DECISION PROCESSING

	County / Agency	POLICE 2010	RFA/ DECP PEN %	PERSNL PEN	FIRE 2010	RFA/ DECP PEN %	PERSNL PEN	EMS 2010	RFA/ DECP PEN %	PERSNL PEN	GOV SVCS 2010	RFA/ DECP PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	25.00%	680	9,063	3.00%	272	3,172	10.00%	317	2,889		0
CT	LITCHFIELD	360	40.00%	144	6,983	40.00%	2,793	3,174	40.00%	1,270	1,449		0
CT	MIDDLESEX	312	40.00%	125	3,434	40.00%	1,374	1,405	40.00%	562	761		0
CT	NEW HAVEN	2,573	25.00%	643	8,575	3.00%	257	2,744	10.00%	274	2,701		0
NJ	BERGEN	2,743	very low	0	4,972	40.00%	1,989	1,543	40.00%	617	2,186	very low	0
NJ	ESSEX	3,364	25.00%	841	3,130	40.00%	1,252	861	33.00%	284	2,181		0
NJ	HUDSON	2,389	25.00%	597	1,409	40.00%	564	368	33.00%	121	1,416		0
NJ	HUNTERDON	249	40.00%	100	3,660	40.00%	1,464	1,610	40.00%	644	783		0
NJ	MERCER	1,226	25.00%	307	3,448	3.00%	103	1,149	10.00%	115	1,188		0
NJ	MIDDLESEX	2,153	very low	0	5,583	40.00%	2,233	1,834	40.00%	734	2,004	very low	0
NJ	MONMOUTH	1,904	very low	0	6,566	40.00%	2,626	1,642	40.00%	657	1,978	very low	0
NJ	MORRIS	1,428	very low	0	5,987	40.00%	2,395	2,210	40.00%	884	1,738	very low	0
NJ	PASSAIC	1,529	25.00%	382	3,244	40.00%	1,298	1,019	33.00%	336	1,298		0
NJ	SOMERSET	906	40.00%	362	4,060	40.00%	1,624	1,405	40.00%	562	1,136		0
NJ	SUSSEX	368	40.00%	147	4,514	40.00%	1,806	1,839	40.00%	736	978		0
NJ	UNION	1,965	25.00%	491	2,368	40.00%	947	655	33.00%	216	1,360		0
NJ	WARREN	221	40.00%	88	3,073	40.00%	1,229	1,229	40.00%	492	648		0
NJ	NJ STATE POLICE	1,467	40.00%	587			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	40.00%	1,259			0			0			0
NJ	NJ OTHER POLICE	363	40.00%	145			0			0			0
NY	DUTCHESS	377	40.00%	151	7,248	40.00%	2,899	2,899	40.00%	1,160	1,457		0
NY	NASSAU	3,779	25.00%	945	6,749	3.00%	202	1,755	10.00%	176	2,953		0
NY	ORANGE	769	40.00%	308	8,079	40.00%	3,232	3,270	40.00%	1,308	1,803		0
NY	PUTNAM	99	40.00%	40	2,174	40.00%	870	889	40.00%	356	432		0

	County / Agency	POLICE 2010	RFA/ DECP PEN %	PERSNL PEN	FIRE 2010	RFA/ DECP PEN %	PERSNL PEN	EMS 2010	RFA/ DECP PEN %	PERSNL PEN	GOV SVCS 2010	RFA/ DECP PEN %	PERSNL PEN
NY	ROCKLAND	594	40.00%	238	2,660	40.00%	1,064	887	40.00%	355	740		0
NY	SUFFOLK	3,289	1.00%	33	14,204	3.00%	426	4,486	10.00%	449	3,981		0
NY	SULLIVAN	79	40.00%	32	4,740	40.00%	1,896	2,370	40.00%	948	928		0
NY	ULSTER	354	40.00%	142	7,084	40.00%	2,834	3,542	40.00%	1,417	1,505		0
NY	WEST-CHESTER	2,514	25.00%	629	7,182	3.00%	215	898	10.00%	90	2,267		0
NY	NY STATE POLICE	877	40.00%	351			0			0			0
NY	NY OTHER POLICE	250	40.00%	100			0			0			0
NY	NEW YORK CITY	37,562	25.00%	9,391	13,132	40.00%	5,253	3,054	33.00%	1,008	148,523	1.50%	2,228
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	0.05%	24
	METRO NORTH RR	200	very low	0			0			0	5,344	0.30%	16
	PORT AUTH NY NJ	700	25.00%	175			0			0			0
	LONG ISLAND RR	250	very low	0			0			0	1,950	0.30%	6
	NJ TRANSIT	150	very low	0			0			0	3,700	0.05%	2
	TOTALS	**83,229**		**19,430**	**153,321**		**43,117**	**51,909**		**16,085**	**251,138**		**2,276**
	PENETR. BY CATEGORY	**23.34%**			**28.12%**			**30.99%**			**0.91%**		

PENETRATION DATA - SLOW SCAN VIDEO

	County / Agency	POLICE 2010	VIDEO-SS PEN %	PERSNL PEN	FIRE 2010	VIDEO-SS PEN %	PERSNL PEN	EMS 2010	VIDEO-SS PEN %	PERSNL PEN	GOV SVCS 2010	VIDEO-SS PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	10.00%	272	9,063	3.00%	272	3,172	10.00%	317	2,889		0
CT	LITCHFIELD	360		0	6,983		0	3,174	10.00%	317	1,449		0
CT	MIDDLESEX	312		0	3,434		0	1,405	10.00%	141	761		0
CT	NEW HAVEN	2,573	10.00%	257	8,575	3.00%	257	2,744	10.00%	274	2,701		0
NJ	BERGEN	2,743	low	0	4,972	low	0	1,543	40.00%	617	2,186	0.00%	0
NJ	ESSEX	3,364	0.50%	17	3,130	0.50%	16	861	5.00%	43	2,181		0
NJ	HUDSON	2,389	0.50%	12	1,409	0.50%	7	368	5.00%	18	1,416		0
NJ	HUNTERDON	249		0	3,660		0	1,610	10.00%	161	783		0
NJ	MERCER	1,226	10.00%	123	3,448	3.00%	103	1,149	10.00%	115	1,188	0.00%	0
NJ	MIDDLESEX	2,153	low	0	5,583	low	0	1,834	40.00%	734	2,004	0.00%	0
NJ	MONMOUTH	1,904	low	0	6,566	low	0	1,642	40.00%	657	1,978	0.00%	0
NJ	MORRIS	1,428	low	0	5,987	low	0	2,210	40.00%	884	1,738		0
NJ	PASSAIC	1,529	0.50%	8	3,244	0.50%	16	1,019	5.00%	51	1,298		0
NJ	SOMERSET	906		0	4,060		0	1,405	10.00%	141	1,136		0
NJ	SUSSEX	368		0	4,514		0	1,839	10.00%	184	978		0
NJ	UNION	1,965	0.50%	10	2,368	0.50%	12	655	5.00%	33	1,360		0
NJ	WARREN	221		0	3,073		0	1,229	10.00%	123	648		0
NJ	NJ STATE POLICE	1,467		0			0			0			0
NJ	NJ DEPT. CORRECT.	3,147		0			0			0			0
NJ	NJ OTHER POLICE	363		0			0			0			0
NY	DUTCHESS	377		0	7,248		0	2,899	10.00%	290	1,457		0
NY	NASSAU	3,779	10.00%	378	6,749	3.00%	202	1,755	10.00%	176	2,953		0
NY	ORANGE	769		0	8,079		0	3,270	10.00%	327	1,803		0
NY	PUTNAM	99		0	2,174		0	889	10.00%	89	432		0

	County / Agency	POLICE 2010	VIDEO-SS PEN %	PERSNL PEN	FIRE 2010	VIDEO-SS PEN %	PERSNL PEN	EMS 2010	VIDEO-SS PEN %	PERSNL PEN	GOV SVCS 2010	VIDEO-SS PEN %	PERSNL PEN
NY	ROCKLAND	594		0	2,660		0	887	10.00%	89	740		0
NY	SUFFOLK	3,289	1.00%	33	14,204	3.00%	426	4,486	10.00%	449	3,981		0
NY	SULLIVAN	79		0	4,740		0	2,370	10.00%	237	928		0
NY	ULSTER	354		0	7,084		0	3,542	10.00%	354	1,505		0
NY	WEST-CHESTER	2,514	10.00%	251	7,182	3.00%	215	898	10.00%	90	2,267		0
NY	NY STATE POLICE	877		0			0			0			0
NY	NY OTHER POLICE	250		0			0			0			0
NY	NEW YORK CITY	37,562	0.50%	188	13,132	0.50%	66	3,054	5.00%	153	148,523	4.00%	5,941
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSITAUTH			0			0			0	48,861	0.75%	366
	METRO NORTH RR	200	0.75%	2			0			0	5,344	0.75%	40
	PORT AUTH NY NJ	700	0.50%	4			0			0			0
	LONG ISLAND RR	250	0.75%	2			0			0	1,950	0.75%	15
	NJ TRANSIT	150	0.75%	1			0			0	3,700	0.75%	28
	TOTALS	**83,229**		**1,556**	**153,321**		**1,593**	**51,909**		**7,062**	**251,138**		**6,390**
	PENETR. BY CATEGORY	**1.87%**			**1.04%**			**13.60%**			**2.54%**		

PENETRATION DATA - FULL MOTION VIDEO

	County / Agency	POLICE 2010	VIDO-FLM PEN %	PERSNL PEN	FIRE 2010	VIDO-FLM PEN %	PERSNL PEN	EMS 2010	VIDO-FLM PEN %	PERSNL PEN	GOV SVCS 2010	VIDO-FLM PEN %	PERSNL PEN
CT	FAIRFIELD	2,719	12.50%	340	9,063	1.00%	91	3,172	0.05%	2	2,889		0
CT	LITCHFIELD	360	5.00%	18	6,983	30.00%	2,095	3,174	5.00%	159	1,449		0
CT	MIDDLESEX	312	5.00%	16	3,434	30.00%	1,030	1,405	5.00%	70	761		0
CT	NEW HAVEN	2,573	12.50%	322	8,575	1.00%	86	2,744	0.05%	1	2,701		0
NJ	BERGEN	2,743	25.00%	686	4,972	40.00%	1,989	1,543	low	0	2,186	0.00%	0
NJ	ESSEX	3,364	12.50%	421	3,130	12.50%	391	861	10.00%	86	2,181		0
NJ	HUDSON	2,389	12.50%	299	1,409	12.50%	176	368	10.00%	37	1,416		0
NJ	HUNTERDON	249	5.00%	12	3,660	30.00%	1,098	1,610	5.00%	81	783		0
NJ	MERCER	1,226	12.50%	153	3,448	1.00%	34	1,149	0.05%	1	1,188		0
NJ	MIDDLESEX	2,153	25.00%	538	5,583	40.00%	2,233	1,834	low	0	2,004		0
NJ	MONMOUTH	1,904	25.00%	476	6,566	40.00%	2,626	1,642	low	0	1,978	0.00%	0
NJ	MORRIS	1,428	25.00%	357	5,987	40.00%	2,395	2,210	low	0	1,738	0.00%	0
NJ	PASSAIC	1,529	12.50%	191	3,244	12.50%	406	1,019	10.00%	102	1,298	0.00%	0
NJ	SOMERSET	906	5.00%	45	4,060	30.00%	1,218	1,405	5.00%	70	1,136		0
NJ	SUSSEX	368	5.00%	18	4,514	30.00%	1,354	1,839	5.00%	92	978		0
NJ	UNION	1,965	12.50%	246	2,368	12.50%	296	655	10.00%	66	1,360		0
NJ	WARREN	221	5.00%	11	3,073	30.00%	922	1,229	5.00%	61	648		0
NJ	NJ STATE POLICE	1,467	5.00%	73			0			0			0
NJ	NJ DEPT. CORRECT.	3,147	5.00%	157			0			0			0
NJ	NJ OTHER POLICE	363	5.00%	18			0			0			0
NY	DUTCHESS	377	5.00%	19	7,248	30.00%	2,174	2,899	5.00%	145	1,457		0
NY	NASSAU	3,779	12.50%	472	6,749	1.00%	67	1,755	0.05%	1	2,953		0
NY	ORANGE	769	5.00%	38	8,079	30.00%	2,424	3,270	5.00%	164	1,803		0
NY	PUTNAM	99	5.00%	5	2,174	30.00%	652	889	5.00%	44	432		0
NY	ROCKLAND	594	5.00%	30	2,660	30.00%	798	887	5.00%	44	740		0
NY	SUFFOLK	3,289	1.00%	33	14,204	1.00%	142	4,486	0.05%	2	3,981		0

	County / Agency	POLICE 2010	VIDO-FLM PEN %	PERSNL PEN	FIRE 2010	VIDO-FLM PEN %	PERSNL PEN	EMS 2010	VIDO-FLM PEN %	PERSNL PEN	GOV SVCS 2010	VIDO-FLM PEN %	PERSNL PEN
NY	SULLIVAN	79	5.00%	4	4,740	30.00%	1,422	2,370	5.00%	119	928		0
NY	ULSTER	354	5.00%	18	7,084	30.00%	2,125	3,542	5.00%	177	1,505		0
NY	WEST-CHESTER	2,514	12.50%	314	7,182	1.00%	72	898	0.05%	0	2,267		0
NY	NY STATE POLICE	877	5.00%	44			0			0			0
NY	NY OTHER POLICE	250	5.00%	13			0			0			0
NY	NEW YORK CITY	37,562	12.50%	4,695	13,132	12.50%	1,642	3,054	10.00%	305	148,523	0.60%	891
	BRONX			0			0			0			0
	KINGS			0			0			0			0
	NEW YORK			0			0			0			0
	QUEENS			0			0			0			0
	RICHMOND			0			0			0			0
NY	METRO TRANSIT AUTH			0			0			0	48,861	1.00%	489
	METRO NORTH RR	200	5.00%	10			0			0	5,344	1.00%	53
	PORT AUTH NY NJ	700	12.50%	88			0			0			0
	LONG ISLAND RR	250	4.00%	10			0			0	1,950	1.00%	20
	NJ TRANSIT	150	1.00%	2			0			0	3,700	1.00%	37
	TOTALS	**83,229**		**10,191**	**153,321**		**29,958**	**51,909**		**1,829**	**251,138**		**1,490**
	PENETR. BY CATEGORY	**12.24%**			**19.54%**			**3.52%**			**0.59%**		

1. U.S. Bureau of the Census. *County and City Data Book: 1994*.

2. Prepared by Urbanomics, a consulting firm, for the New York Metropolitan Transportation Council, a planning organization of New York State government. The chart was last revised on 9/18/95.

3. New York State, Division of Criminal Justice Services, *1993 Crime and Justice Annual Report*.

4. State of New Jersey, Division of State Police, *Uniform Crime Reports, State of New Jersey, 1993*.

5. *Fire and EMS Data Book* is a compilation of detailed information on the resources available in the county of Nassau. The data included information on the number of personnel in each category.

6. *The 1994-95 Green Book* is an official directory of the City of New York.

7. Taken from *New York City Transit's Facts & Figures: 1995* booklet. Commodity Number 22-30-0202, Log Number 1095038, Printed 5/95.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment	)	ET Docket No. 02-135
by the Spectrum Policy Task Force	)	
	)	
	)	
To: The Commission		

COMMENTS OF

Statewide Wireless Network

New York State Office for Technology

6C Executive Park Dr.

Albany, NY 12203-3716

July 8, 2002

Appendix 3

Appendix B of the PSWAC Technology Subcommittee Final Report
p. 79 (269)

APPENDIX B
TECHNOLOGY INVENTORY SUMMARY

COMPANY	TECHNOLOGY DESCRIPTION - Note 1	SIGNAL TYPES Note 2	BANDWIDTH	CHAN. Note 3	ACCESS	DATA RATES Note 4	VOCODER	ENCRYPTION	C/D/F Note 5
Transcrypt	FDMA Project 25	V, LD	12.5 kHz	1	FDMA	9,600	IMBE	Yes	D
Ericsson	EDACS	V	25/12.5 kHz	1	FDMA	N/A	N/A	No	C
Ericsson	EDACS/Aegis Standard	V, LD, SV	25/12.5 kHz	1	FDMA	9,600	AME	Yes	C/D
Ericsson	EDACS/PrismNarrowband	V, LD, SV	12.5 kHz	1	FDMA	9,600	IMBE	Yes	D
Ericsson	EDACS/Prism-TDMA	V, LD, PIC, VID	12.5 kHz	2	TDMA	16,000	IMBE	Yes	D
Motorola	IDEN/MIRS	V, LD, HD	25 kHz	3 or 6	TDMA	64,000	VSELP	No	C
Motorola	ASTRO-FDMA Project 25	V, LD	12.5 kHz	1	FDMA	9,600	VSELP/IMBE	Yes	C/D
NTT America	RZ SSB	V, LD, SV, PIC	5/6.25 kHz	1	FDMA	19,200	PSI-CELP/VSELP	Yes	D
NTT America	RZ SSB	V, LD, SV, PIC	5/6.25 kHz	2	TDD	19,200	PSI-CELP/VSELP	YES	D
NTT America	RZ SSB	V, LD, SV, PIC	10/12.5 kHz	2 or 4	TDMA	38,400	PSI-CELP/VSELP	YES	D
EF Johnson	LTR	V	25 kHz	1	FDMA	9,600	N/A	No	C
EF Johnson	Multi-Net	V	25 kHz	1	FDMA	9,600	N/A	No	C
EF Johnson	LTR-2	V	25 kHz	1	FDMA	9,600	N/A	No	F
EF Johnson	Multi-Net 25	V, LD	25/12.5 kHz	1	FDMA	9,600	IMBE	Yes	F
Midland	FDMA Project 25	V, LD	25/12.5 kHz	1	FDMA	9,600	IMBE	Yes	D

NOTES:
- #1 Trademark descriptions are used for some descriptors.
- #2 V = Voice, LD = Low Speed data (defined as up to 19.2 kbps), HD = High Speed data (defined as > 56 kbps, SV = Slow video, PIC = Snapshot Picture, VID = Video
- #3 Channels per carrier
- #4 The raw data rate is used.
- #5 C = Currently type accepted, D = Developmental, F = Future technology

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment	)	ET Docket No. 02-135
by the Spectrum Policy Task Force	)	
	)	
	)	
To: The Commission		

COMMENTS OF

Statewide Wireless Network
New York State Office for Technology
6C Executive Park Dr.
Albany, NY 12203-3716

July 8, 2002

Appendix 4

Appendix C of the PSWAC Technology Subcommittee Final Report pp. 80 (270) - 84 (274)

APPENDIX C

TECHNICAL PARAMETERS FOR FORECASTING SPECTRUM DEMAND

The model which has been selected for the computation of the spectrum need of public safety is described in the report of the Spectrum Subcommittee. That model calls for technological parameters to be projected through the year 2010 for the identified user service needs, and then used to compute the spectrum needed. The user service needs which have been identified by the Operational Requirements Subcommittee are: Voice Dispatch, Telephone Interconnect, Transaction Processing, Facsimile, Snapshot, Remote File Access, and Slow and Full Scan Video. The following provides a detailed description of the technology parameters used in the process and identifies a recommended value for each parameter.

TECHNOLOGY PARAMETERS

Description	Abbreviation
RF Transmission Rate	RATE
Error Control and Overhead	ERR
Source Content	SRC
Channel Occupancy	LOAD
Coding Improvement	COD

1.0 RF Transmission Rate (RATE)

The word RATE will be used to designate the RF transmission rate in the model. It is described in bits per second per Hertz (b/s/Hz). The leading edge technology in use was projected to be 3.5 b/s/Hz in the year 2000 and 5.0 in the year 2010. Assuming a 15 year life, the systems in use in the year 2010 will be the accumulation of systems sold starting with those purchased today and including those that will be sold in the year 2010. Those sold today include some which are at the level of about 2.5 b/s/Hz and some that are less than 1.0 b/s/Hz. Those sold in the year 2010 will likewise have a range of values. Projected values are summarized in Table 1.

Table 1
Transmission Rate

Service	b/s/hz
all except video and remote file transfer	1.5
video and remote file transfer	3.5

2.0 Error Control and Overhead (ERR)

In the model, we will use ERR to represent the subject parameter, and it will be expressed in the average percent of transmitted bit rate that is dedicated to this function.

Coding of the information bits allows more and more compression to take place. However, each bit then becomes more important, and the error correcting function then becomes more important. In addition, over time, linear modulation schemes are being used with higher transmission rates. Because of the multipath propagation environment, it becomes necessary to provide synchronization and equalization functions that also may use some capacity.

Table 2
Error Control and Overhead

Today	Future
55 %	50 %

3.0 Source Content (SRC)

The content of the source message to be transmitted is represented by the shortened form SRC in the equations to follow. In the future, it is projected that all services provided will be implemented in a digital format. Therefore, this parameter will be expressed in kilobits per second (kb/s).

The offered load that has been developed in User Traffic Profile White Paper [1] is based on a source content of 6 kb/s per second for all categories except special data, and that will be used herein. For special data, consisting of video and remote file access, it will be prohibitive to limit the channel to such a slow data rate. In Appendix C of the Prediction Model White Paper[2] values are developed for these latter services, and a nominal rate developed there is 384 kb/s. That is the value which will be used for the spectrum computation.

The magnitude of the source content is that which is contained in the state of the art message today, including any coding improvement that has been done to date. Advances in coding in

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1 United States Department of Justice, Immigration and Naturalization Service, Headquarters Radio Systems Section, "Public Safety Wireless Communications User Traffic Profiles and Grade-Of-Servic e Recommendations", March 13, 1996, prepared by Dr. Gregory M. Stone. Referenced here as "User Traffic Profiles White Paper."

2 White Paper "Model For Prediction Of Spectrum Need Through The Ye ar 2010", Version 2.0, May 27, 1996, presented To PSWAC by Motorola Inc. Referenced here as "Prediction Model White Paper."

the future are addressed in the parameter COD developed below. The resulting content of the advanced features for SRC is summarized in Table 3.

4.0 Channel Occupancy (LOAD)

Channel loading is the portion of time the channel has RF transmitted over it expressed in percent of the total time the channel is available. It is represented by the term LOAD, and is a complex subject that is a function of many parameters. These parameters include the kind and urgency of the message, the number of users of the channel, how many servers are available for the channel, and the length of message and number of them per hour offered by the users.

An example of a situation where a lightly loaded channel is necessary is when a group of scattered police officers are waiting to simultaneously close in on a suspect with a hostage. They operate on a single channel, and It is imperative that when the word go is uttered they all move with the greatest of speed. The channel in use must be **very** lightly loaded, LOAD less than 5 percent, to assure that the short message will not be blocked.

An example of a situation where a heavily loaded channel can be used involves trunked systems that carry routine messages. Data requests for license plate checks can wait two or three seconds as the officer writes a ticket. A dispatcher request for present location usually takes a few seconds for a voice reply as the officer reaches for the radio to reply. That too will not suffer greatly if two or three seconds of blockage occur. LOAD can be 20 to 25 percent on a single channel system and as much as 70 to 80 percent on 20 channel trunked systems and meet this criteria.

Finally, there are messages that can wait for a few minutes before delivery to the intended party. These may include a FAX sent to an individual driving a car (we recommend that they keep their eyes on the road as opposed to reading a FAX), and E-Mail message, or a long file which is to be used at some time in the future. Single channel systems can be loaded up to 50 percent and 20 channel systems up to 95 percent and provide this service. For purposes of the analysis of spectrum need a value of 55 percent is recommended.

5.0 Coding Improvement (COD)

The coding improvement is a dimensionless factor that describes the anticipated improvement in coding that will take place between the years 1996 and the year 2010. The shortened term COD is used in the model. For various services, the value of COD varies from 1 to 3 as shown in Table 3.

6.0 Recommended Parameters For Model

Based on the discussions above, the technological parameters have been quantified for each of parameters identified are summarized in Table 3.

Table 3
SUMMARY OF TECHNOLOGY PARAMETERS

SERVICE	RATE b/sec/Hz	ERR %	SRC kb/s	LOAD %	COD
Voice Dispatch	1.5	50	6	55	2
Telephone Interconnect	1.5	50	6	55	2
Transaction Processing	1.5	50	6	55	2
Facsimile	1.5	50	6	55	1
Snapshot	1.5	50	6	55	1
Remote File Transfer	3.5	50	384	55	3
Slow Scan Video	3.5	50	384	55	3
Full Motion Video	3.5	50	384	55	3

Before the
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Washington, D.C. 20554

In the Matter of	)	
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Solicitation of Public Comment by the Spectrum Policy Task Force	)	ET Docket No. 02-135
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To: The Commission		

COMMENTS OF

Statewide Wireless Network

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July 8, 2002

Appendix 5

Appendix C of the PSWAC Spectrum Requirements Subcommittee Final Report
pp. 65 (671) - 79 (685)

APPENDIX C

PUBLIC SAFETY WIRELESS ADVISORY COMMITTEE MODEL FOR PREDICTION OF SPECTRUM NEED THROUGH THE YEAR 2010

A WHITE PAPER

MOTOROLA **DRAFT v1.1** **February 2, 1996**

EXECUTIVE SUMMARY

The present service requirements of the public safety community that relate to wireless communications have been identified and projected through the year 2010. Future service requirements have also been identified that are made possible by advances in semiconductor and computer technology that will add to the efficiency and safety of public safety officers as well as the communities which they serve. All of these service requirements include voice, data, image and video. For each of these, the average number, duration, and message load offered, as they relate to the use of wireless communications now and in the future, have been quantified.

The technological parameters that relate the service requirements to spectrum need include RF transmission rate, digital coding, channel occupancy, and error control. The historical rate of change in these have been determined, and then projections were made into the future. A geographical model of Los Angeles which contained 390 thousand public safety officers with advanced services radios was then identified as shown below. The spectrum need for each was also determined as shown, and this is the basis that shows that 84 MHz of RF spectral bandwidth should be provided for public safety applications through the year 2010.

Spectrum Requirements 1996 through 2010

SERVICE	THOUSANDS OF USERS	SPECTRUM BANDWIDTH MHZ
VOICE	273	20
TRANSACTION PROCESSING	195	5
FACSIMILE	117	9
SNAPSHOT	156	19
DECISION PROCESSING/ REMOTE FILE TRANSFER	117	14
SLOW VIDEO	27	6
FULL MOTION VIDEO	3	9
COMPUTATION TOLERANCE	NA	2
TOTAL		84

I. INTRODUCTION

The goal of the Public Safety Wireless Advisory Committee is primarily to advise the FCC and NTIA on the "operational, technical, and spectrum requirements of federal, state, and local public safety entities through the year 2010."[1] The objective is to bring about significant enhancement to the effectiveness and efficiency of public safety communications. Wireless communications have been well used by public safety in the past, and with proper planning, even better use can be made in the future.

This paper will examine the implications of semiconductor advances on computing and telecommunications, and the wireless offering of related services that will impact the public safety community.[2] The present state of semiconductor technology is reviewed in Appendix A, and the cost impact on one market is illustrated. The operational requirements of public safety will be reviewed and projected through the year 2010.

It is the function of this paper to present the best intellectually supportable forecast for the spectrum needed by public safety by 2010. A model will be used that is based on a projection of the current state of digital compression and wireless radio delivery technologies that apply to public safety needs. From that, a forecast is made for the amount of spectrum which will be needed for specific advanced telecommunication services through the year 2010.

II. SPECTRUM PREDICTION MODEL

We are herein proposing an engineering methodology for projecting spectrum needs. We will show a methodical approach to projecting the trends of key technologies, and how that approach can be employed to predict future spectrum requirements. The relationships between need and required spectrum can be described in terms of technical parameters. Mathematical equations can then be used to project the bandwidth of spectrum required. This methodology has been previously employed in the COPE[3] petition, and we use this as a starting point. The steps to be used are:

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1 FCC/NTIA Report No WT 95-22, Wireless Telecom Action, September 8, 1995.

2 This paper draws heavily from a paper by Allen Davidson and Larry Marturano titled Impact of digital techniques on future LM spectrum requirements, IEEE Vehicular Technology Society News, May, 1993. New material given in this paper and some material deemed of importance will be referenced herein. The reader is referred to the predecessor paper for complete citations.

3 Coalition of Private Users of Emerging Multimedia Technologies (COPE), FCC Petition for Rule Making, Spectrum Allocations for Advanced Private Land Mobile Communications Services, filed 12/23/93. COPE represents many private users of land mobile radio, including public safety organizations such as the Association of Public Safety Communications Officials, International (APCO) and the Public Safety Communications Council (PSCC).

1) Identify the geographical area over which the model will be applied and the population of officers who will use the services to which the model applies. We will use the greater Los Angles area herein.

2) Identify the advanced services that will be used by the public safety community through the year 2010.

3) Identify a self consistent set of technical parameters that can relate the usage of the advanced services to the spectrum required in a spectrally efficient manner.

4) Quantify those technical parameters for each of the advanced services.

5) Compute the spectrum need for each of the advanced services and sum them to obtain the total spectral need for public safety through the year 2010.

Each of these will be discussed in turn in the sections to follow. The application of semiconductor technology to radio communications has resulted in certain technology trends that can be useful in these discussions. Several of these trends are presented in Appendix B.

A. Metropolitan Area and Population (POP)

Above we identified the greater metropolitan area of LA as the area which will be used for the computation.[4] The population of public safety users there has been evaluated by the Association of Public Safety Communications Officials (APCO).[5] They show that there were an estimated 78,000 mobile and portable radios in the Los Angeles area in the year 1985, and that this number was estimated to grow to 155,000 by the year 2000.

However, the actual growth in the number of licensed mobile and portable radios in the public safety service between 1985 and 1990 as published by the FCC was much greater than had been estimated in 1985. The actual growth rate by the year 1990, 11.6 percent, produced 135,000 mobiles and portables. Using a much more conservative growth rate of 6.0 percent from 1990 to 2000 and 5.0 percent from 2000 to 2010 they projected that the population of public safety units will be 390,000 by the year 2010.

We will use this estimate as the population for our computation herein; it will be abbreviated POP in the equations to follow. This number may appear to be somewhat large for the population of resident public safety officers in the greater metropolitan area of Los Angeles. However, when one considers the case of a large emergency, where virtually all of the normal activities continue, and there is a large influx of additional resources which must interpolate with the resident population, the number seems very reasonable.

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4 It would have been possible to use the areas around New York or Chicago as these are crowded users of the spectrum and would also have provided a valid result.

5 The impact of Advanced Technologies on Public Safety Spectrum Requirements, prepared by APC O Spectrum Needs Task Force, July 1994

B. Advanced Services

The advanced services which will be available to the public safety community by the year 2010 are:

Table 1
Advanced Services

- voice dispatch (to support other services)
- telephone interconnect
- transaction processing
- facsimile
- snapshot
- decision processing/remote file access
- slow video
- full motion video

Each of these are described in detail in Appendix C and will not be described further here. The land line services that are driving the need for these advanced services in the public safety environment are also described in Appendix C. Further, some examples are given there of the first steps being taken to bring them into the wireless world.

C. Technical Parameters

A set of parameters that apply to the model at hand are given below, and each of them will be described further in the paragraphs to follow.

Table 2
Parameters Used in Model

- penetration of each service into the target population (%)
- source content (kbytes or kbits/sec)
- expected coding improvement (factor)
- average duration of message (sec)
- calls per hour (number)
- RF transmission rate (bits/sec/Hz)
- error control (% of transmission)
- average busy hour channel loading factor (related to blocking, %)
- geographic reuse factor (factor)

1. Service Penetration Into Target Population (PEN)

The penetration of each of the services into the population of public safety users is represented by the shortened form PEN in the equations to follow. It is a dimensionless quantity that may be expressed as a percentage, and as the penetration into any service increases, the amount of spectrum needed will also increase.

Each of the above identified services will not be used by all of the population of 390 thousand users of the advanced services identified above. For example, transaction processing functions will probably be used frequently by a traffic officers as they request data on license numbers. But they will probably not use telephone interconnect in their regular duties. An officer on foot may frequently receive mug shots of individuals who are wanted for some reason. But they will not usually need to transmit or receive long files such as locations of gas lines or power lines such as a firefighter is interested in.

The estimation of the penetration should also take into account that out of the ordinary emergencies require services that may not be used on an every day basis. Thus, adequate penetration should provide for the unusual. The penetration that will be used in the sample computation to follow is given in Table 3.

Table 3
Penetration of Services Into the User Population

SERVICE	PENETRATION, %
Voice	50
Transaction Processing	50
FAX	30
Snapshot	40
Remote File Access	30
Slow Video	7
Full Motion Video	0.7

2. Source Content (SRC)

The content of the source message to be transmitted is represented by the shortened form SRS in the equations to follow. It is given in two forms, depending on the service being discussed. Those services which have a stringent latency requirement, which include voice, telephone interconnect, slow video, and full motion video, are expressed in bits per second.

The data services which include transaction processing, snapshot, facsimile and decision processing are given in kbytes. In order to determine the number of bits per second required of these services, we multiply by 8 to determine the number of bits, and then divide by the average duration of the message which is described in 5 below.

The magnitude of the source content is that content which is contained in the state of the art message today, including any coding improvement that has been done. Advances in coding are addressed in the next parameter. The content of the advanced features is discussed in Appendix C, and are summarized in Table 4.

3. Coding Improvement (COD)

The coding improvement is a dimensionless factor that describes the anticipated improvement in coding that will take place between the years 1996 and the year 2010. The shortened term

COD is used in the equations to follow. This too is described in Appendix C and in Table 4 below.

Table 4
Source Content, Compression Ratio, and Future Content

ADVANCED SERVICE	CONTENT	IMPROVEMENT	FUTURE SOURCE CONTENT
Decision Processing/ Remote File Transfer	200 kbyte	2 to 1	100 kbyte
4 Page FAX	92 kbyte	3 to 1	31 kbyte*
SNAPSHOT, including			
Fingerprint Inbound	3 kbyte	1 to 1	3 kbyte
Fingerprint Outbound	6.25 kbyte	1 to 1	6.25 kbyte
Mug Shot Outbound	2.5 kbyte	1 to 1	2.5 kbyte
EMS Picture	103 kbyte	2 to 1	51 kbyte
Slow Video	384 kbps	3 to 1	128 kbps
Full Motion Video	1.5 kbps	3 to 1	500 kbps

4. Duration of Message (DUR)

The needs of each mobile officer who uses the services in question will now be predicted. The length, or duration, of the messages on the RF link will be called the DUR in the equations to follow.

Table 5 summarizes the number of seconds that each transmission will take on average. In the case of voice dispatch, the length of the message on private trunked systems averages about 24 seconds and on community repeaters it averages about 17 seconds.[6] On public safety systems the length us frequently less because of the strict discipline enforced on those systems. Telephone interconnect calls are usually much longer, and in the public safety environment, where there may be a hostage situation, the length can become hours. However, the average call length for the composite voice application which is used in conjunction with the advanced services is taken as 24 seconds.

The length for the video applications is estimated based on the information that might be obtained from the periodic observation of a fire or a crowd. The estimated times for the data applications are taken from those applications in use on wire based computers today.

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6 Garry C. Hess, Land-Mobile Radio Sys tem Engineering, Artech House, Boston - London, 1993, pp.249-253.

Table 5 Length of Messages on Advanced Systems	
SERVICE	**AVERAGE MESSAGE LENGTH SEC.**
VOICE	24
TRANSACTION PROCESSING	1
FACSIMILE	15
SNAPSHOT	20
DECISION PROCESSING/ REMOTE FILE TRANSFER	15
SLOW VIDEO	210
FULL MOTION VIDEO	210

5. Messages Per Hour (MPH)

Service usage will be quantified in terms of the numbers of requests for service per user in the busy hour, and this parameter will be called MPH in the equations to follow. The proposed usage model is summarized in Table 6. These have been gleaned from many sources over time. Where possible, wireless data has been used, but where none is available, data from wireline use has been extrapolated The use of traditional voice and data services as well as newer advanced services have been included. Also, full motion video is expected to be viable by the 2000 time frame, and it is expected to find more use as it is placed in the hands of the users.

Table 6 Advanced Service Usage Rates Per Hour	
SERVICE	**AVERAGE REQUEST RATE PER HOUR**
VOICE	3
TRANSACTION PROCESSING	6
FACSIMILE	0.5
SNAPSHOT	1

Table 6
Advanced Service Usage Rates Per Hour

SERVICE	AVERAGE REQUEST RATE PER HOUR
DECISION PROCESSING/ REMOTE FILE TRANSFER	0.5
SLOW VIDEO	0.1
FULL MOTION VIDEO	0.4

6. RF Transmission Rate (RATE)

The word RATE will be used to designate the RF transmission rate in the equations to follow. The historical transmission rate is discussed in Appendix B. The leading edge technology in use was projected there to be 3.5 in the year 2000 and 5.0 in the year 2010. Assuming a 15 year life, the systems in use in the year 2010 will be the accumulation of systems sold starting with those purchased today and including those that will be sold in the year 2010. Those sold today include some which are at the level of about 2.5 b/s/Hz on Figure B2 and some that are less than 1.0 b/s/Hz. Those sold in the year 2010 will likewise have a range of values.

By using crude integration, we arrive at a values of 1.5 b/s/Hz that can provide all of the advanced features in a reasonable bandwidth for all applications except video. For slow and full motion video we use 3.5 b/s/Hz.

7. Error Control and Overhead (ERR)

In the equations to follow, we will use COD to represent the subject parameter, and it will be expressed in the average percent of transmitted bit rate that is dedicated to this function.

Coding of the information bits allows more and more compression to take place. However, each bit then becomes more important, and the error correcting function then becomes more important. In addition, over time, linear modulation schemes are being used with higher transmission rates. Because of the multipath propagation environment, it becomes necessary to provide synchronization and equalization functions that also use some capacity.

State of the art systems in operation today use up to 55 percent of their transmitted bit rate for error correction and overhead. Because increased emphasis will be given in the future, we will project that this parameter will only improve to 50 percent for all of the services by the year 2010.

8. Channel Loading (LOAD)

Channel loading is the portion of time the channel has RF transmitted over it expressed in percent of the total time the channel is available. It is represented by the term LOAD, and is a complex subject that is a function of many parameters. These parameters include the kind and urgency of the message, the number of users of the channel, how many servers are available for the channel, and the length of message and number of them per hour offered by the users.

An example of a situation where a lightly loaded channel is necessary is when a group of scattered police officers are waiting to simultaneously close in on a suspect with a hostage. They operate on a single channel, and It is imperative that when the word go is uttered they all move with the greatest of speed. The channel in use must be **very** lightly loaded, LOAD less than 5 percent, to assure that the short message will not be blocked.

An example of a situation where a heavily loaded channel can be used involves trunked systems that carry routine messages. Data requests for license plate checks can wait two or three seconds as the officer writes a ticket. A dispatcher request for present location usually takes a few seconds for a voice reply as the officer reaches for the radio to reply. That too will not suffer greatly if two or three seconds of blockage occur. LOAD can be 20 to 25 percent on a single channel system and as much as 70 to 80 percent on 20 channel trunked systems and meet this criteria.

Finally, there are messages that can wait for a few minutes before delivery to the intended party. These may include a FAX sent to an individual driving a car (we recommend that they keep their eyes on the road as opposed to reading a FAX), and E-Mail message, or a long file which is to be used at some time in the future. Single channel systems can be loaded up to 50 percent and 20 channel systems up to 95 percent and provide this service. Table 7 summarizes the estimated average channel loading that will be attained by the year 2010 for all of the public safety services being considered herein.

Table 7
Assumed Public Safety Channel Loading in the Year 2010

SERVICE	AVERAGE CHANNEL LOADING, %
VOICE	40
TRANSACTION PROCESSING	50
FACSIMILE	60
SNAPSHOT	60
DECISION PROCESSING/ REMOTE FILE TRANSFER	60

Table 7
Assumed Public Safety Channel Loading in the Year 2010

SERVICE	AVERAGE CHANNEL LOADING, %
SLOW VIDEO	50
FULL MOTION VIDEO	50

9. Geographic Reuse (REUS)

This parameter is a dimensionless factor which will be called REUS in the material to follow. There are three states for REUS, it may be greater than, equal to, or less than 1.0. We will look at each of these in turn.

"Talk around" is a function that is used on systems with two frequency repeaters with no additional infrastructure. Mobile or portable radios disable their repeater function and use their radio in a single frequency simplex mode, public safety unit direct to unit. They use the base talk out frequency, but because they are so close together, their signal dominates the signal received at the base. Many individuals can simultaneously use this function in the same geographic region, in addition to those using the repeater. Thus, the reuse factor is greater than 1.0. REUS can perhaps be as high as 5 or 10 depending on the number of officers simultaneously using this function.

A second way that REUS can be greater than 1.0 is by the use of a cellular like system. Here, the same channel is used more than once in the same geographic area. That channel traditionally used Frequency Division Multiple Access (FDMA), but Code Division Multiple Access (CDMA) has been implemented in the past few years. Cellular FDMA has demonstrated REUS factors of 4 to 6 in a given geographic area while CDMA proponents claim REUS equivalent factors of 10.[7] This technology is not yet been proven in fully loaded service, so it is premature to conclude what this technology is capable of at this time.

Two frequency repeaters with high base antennas which cover wide geographic areas are the technology that provides a REUS factor of 1.0. These can either be conventional or trunked repeaters; it makes no difference to the REUS factor.

Finally, REUS factors less than 1.0 are provided by simulcast systems that use multiple transmitters on the same RF frequency that broadcast the same message content. This also applies to multiple transmitters on different frequencies that broadcast the same message.

[7] When CDMA was new, advocates claimed REUS factors of 20 would be possible. However, at the December 13 PSWAC Technology Subcommittee meeting, rep resentatives of CUALCOMM, Inc. and Airtouch Cellular stated that a factor of 10 is possible. We note that the trend of claims is decreasing. It is probably necessary to wait until fully loaded systems are in place demonstrating this capability before REUS for CDMA will be known.

These frequently take the form of state wide systems. Because the frequency can not be reused in the next geographic area, REUS will be less than unity. The value of REUS will be the ratio of the area covered by one high site repeater to the area covered by the multisite system. So, if the system covers the area which two high repeater sites normally covers, REUS = 0.5. If it covers the area of four sites it will be 0.25, and so on.

The amount of reuse that can occur is dependent on the advanced service being considered because the area of needed coverage varies. The value of REUS that will be used in the analysis to follow is given in Table 8 for each service.

Table 8
Public Safety Spectrum Reuse Factor by 2010

SERVICE	AVERAGE REUSE FACTOR
VOICE	2
TRANSACTION PROCESSING	3
FACSIMILE	3
SNAPSHOT	3
DECISION PROCESSING/ REMOTE FILE TRANSFER	4
SLOW VIDEO	4
FULL MOTION VIDEO	1

D. Spectrum Computation

At this point, the technological capabilities related to providing voice, transaction processing, FAX, snapshot, decision processing and file transfer, slow and full motion video have been characterized. The parameters that relate to the use of them by the public safety community have also been quantified. The spectrum needed to provide these services through the year 2010 must now be determined.

1. Model Equations

The equation that relates all of the user service capabilities and technical parameters to spectrum need is given in (1), where FREQ is the frequency in MHz and K is a normalization parameter used to accommodate the units and the type of service being analyzed.

$$\text{FREQ} = K \frac{\text{POP} \times \text{PEN} \times \text{SRC} \times \text{DUR} \times \text{MPH}}{\text{COD} \times \text{RATE} \times \text{LOAD} \times \text{REUS} \times \text{ERR}} \qquad (1)$$

For two frequency repeater operation, there is a factor of 2 included in K because two bandwidths are used that are separated by the inbound and outbound frequency. We will assume that the slow and full motion video services are single frequency simplex, and therefore only transmitted one way. So the factor of 2 only applies to the other services

In order to express the answer in MHz, and with the units described above, the additional factor of 1/3600 must be used because the service requests are expressed in terms of number per hour, and all other parameters involve seconds.

Finally, the voice and video services source content were described in terms of kb/sec while the data related services were described in terms of kbytes. In order to quantify the spectral need, we will assume that the transmitted rate just meets the time required to get the message through. So, for the data related services there is an additional factor of 8/DUR required. The constant K is summarized in Table 9.

Table 9
Normalization Factor K for Each Service

SERVICE	K
VOICE	2/36.00
TRANSACTION PROCESSING	16/(36.00*DUR)
FACSIMILE	16/(36.00*DUR)
SNAPSHOT	16/(36.00*DUR)
DECISION PROCESSING/ REMOTE FILE TRANSFER	16/(36.00*DUR)
SLOW VIDEO	1/36
FULL MOTION VIDEO	1/36

2. Spectrum Needs: 1996-2010

The predicted public safety radio needs given above, coupled with the technological capabilities to meet these needs, described earlier, allow a calculation of the spectrum that will be required for advanced communication services as the year 2000 approaches. The results are presented in Table 10. An estimate of the spectrum needs for voice services is also included, based upon expected efficiency improvements in the current land mobile allocation, and the needs of advanced services users for traditional voice services. The number of users within the geographic area that need the spectrum are also listed. These spectrum requirements are expected to increase through the year 2010 as the penetration for these services increase and there is a greater dependence on multimedia information.

Table 10
Spectrum Requirements 1996 through 2010

SERVICE	THOUSANDS OF USERS	SPECTRUM BANDWIDTH, MHZ
VOICE	273	20
TRANSACTION PROCESSING	195	5
FACSIMILE	117	9
SNAPSHOT	156	19
DECISION PROCESSING/ REMOTE FILE TRANSFER	117	14
SLOW VIDEO	27	6
FULL MOTION VIDEO	3	9
TOTAL		82

3. Tolerances in Parameters Used and Result

The parameters that were used in the computation above all require judgment in their selection and in the levels to which they were quantified. Additional time could be used to reduce the tolerance in each of the parameters, however, with the limited time available they are the best that could be done. It is believed that the computation involved in each of the bandwidths required for each service in Table 10 can have a one standard deviation error of 30%. Assuming that the errors are normally distributed, the probable error in the total is the square root of the sum of the squares of the separate errors. The first standard deviation error in total is therefore 2 MHz. So, in order to accommodate this error, it is recommended that a total of 84 MHz be made available to the public safety community by the year 2010.

4. Prediction Reliability

This vision of the future is a prediction and, like any other prediction, is subject to some debate. Although the details of the vision just described may unfold somewhat differently as time goes on (e.g. in the case of full motion video as a land mobile service), the nature of the vision should be accurate. The "details" of the vision will be driven by a combination of innovative technologies and innovative users.

This model and it's reliability represent a comprehensive and scientific approach that has been assembled through the cooperation of the wireless communications industry and public safety user experts. The resulting conclusions and forecasts provide the FCC and NTIA with a firm foundation for allocating adequate spectrum for public safety.

There is a need to revisit the prediction periodically because there are many factors which can hasten or delay the use of these advanced services. Perhaps the largest factor influencing the speed at which these innovative technologies can be introduced will be the availability of adequate spectrum. This prediction is made on the basis that some spectrum be allocated within the next year, and also that a plan be put in place for reaching the required bandwidth. It is recommended that the prediction be revisited at 5 year intervals to determine if changes have occurred that would call for a revision of the spectrum need. Historically, such predictions have fallen short in stating the need. With periodic reexamination of the need, the safety, effectiveness and efficiency of the public safety community can be maintained at the necessary level.

III. CONCLUSION

Advances in semiconductor technology are one of the major enablers for the introduction of advanced telecommunications and computing applications and services. The introduction of these services in the home or office environment tends to increase the demand for ubiquitous wireless access to these same services shortly thereafter. We have also seen how the same semiconductor technology which creates the demand for these services in the wireline environment provides solutions for wireless access, by making advanced spectrally efficient modulation and source encoding techniques economically viable for mass production. These advances have been utilized by public safety mobile radio equipment manufacturers and service providers to pace the past user demand for new wireless services.

However, due to expected proliferation of advanced digital services through the year 2010, it is expected that the increase in demand will overtake the additional capacity offered by technological improvements. In order for these advanced telecommunications services, like file transfer, fax, imaging and video, to be offered to the public safety community, it is necessary that adequate spectrum be provided to make up for the shortfall between the anticipated demand and the expected advances in efficiency of presently allocated spectrum. The total spectrum that should be provided for public safety through the year 2010 is 84 MHz.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment by the Spectrum Policy Task Force	)	ET Docket No. 02-135
	)	
	)	
	)	
To: The Commission		

COMMENTS OF

Statewide Wireless Network

New York State Office for Technology

6C Executive Park Dr.

Albany, NY 12203-3716

July 8, 2002

Appendix 6

Appendix D of the PSWAC Spectrum Requirements Subcommittee Final Report pp. 80 (686) - 105 (711)

APPENDIX D

Public Safety Wireless Communications User Traffic Profiles and Grade-Of-Service Recommendations

13 March 1996
Revision-0

Submitted to:

PUBLIC SAFETY WIRELESS ADVISORY COMMITTEE (PSWAC)

Submitted By:

United States Department of Justice
Immigration and Naturalization Service
Headquarters Radio Systems Section

Prepared by:

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ABSTRACT

This paper presents a structured approach and methodology recommended for the modeling and simulations of conventional (including those with composite control) and trounced public safety wireless communications systems based upon traffic engineering principles. These recommendations include: the provision of standard public safety user traffic profiles; adoption of the Poisson and Erlang-C traffic and delay equations; establishment of a recommended grade of service, priority and response times for public safety wireless communications.

ACKNOWLEDGMENTS

The traffic profiles presented in this paper owe their origin to the significant works of Mr. Mark Racek and Mr. Ed Kelly of Ericsson and Mr. Keith Barnes of the E.F. Johnson Company. We continue to acknowledge the receipt of valuable comments and suggestions from a number of individuals and entities. We are appreciative of the contributions to this process provided by Mr. Paul Derynck of the Calgary Police Service and APCO Canada, as well as those from EEG, Motorola and GEC-Marconi. In addition, Mr. Richard Roley from the State of Georgia and Mr. R.E. Ginman Head of Radio Frequency and Communications Planning Unit, of the United Kingdom's Home Office provided valuable data from existing systems that were considered in the construction of these metrics. Using the Ericsson and EFJ materials as a point-of-departure, we have made substantive changes, especially in the numerical offered load values.

1. INTRODUCTION

The impetus behind the development of a standard or baseline traffic profile was to assist the global PSWAC effort through providing a set of modeling and simulation constraints concerning public safety offered load that may be of use in determining comparative performance between current and future technology implementations.

Since the initiation of this traffic profile and grade-of-service (GOS) recommendation process, considerable evolution of the standard profiles has occurred, most as a result of reconciling philosophical differences between how a metric should be constructed and some by assimilating additional real world data.

To facilitate document utility, we have segregated the presentation of "SPECIAL" data (defined as data with file sizes of 30 kiloBytes or larger (KB)) requirements from the aggregate offered load metric standard. Notwithstanding this segregation, we have become more confident that SPECIAL data and imaging usage will predominate in the future. These forecasts are indeed problematic as no currently available commercial wireless technology implementation can support the information transfer intensive requirements imposed by SPECIAL data.

Our basis for these statements is straightforward. There is historical precedent that when query type wireless data is used in public safety, certain types of voice traffic tend to decrease. In addition, as most query types of data are of a relative small file size in the order of a few hundred Bytes, the transfer times needed are modest even at relatively low information transfer rates. Public safety users are accustomed to fairly rapid response times for both voice and data services. Systems are hopefully designed to support typical voice traffic profiles. When data services that involve large file sizes are attempted, both the information transport and processing and turnaround times tend to become significant. If a system is sized to accommodate a certain quantity of five second messages and the traffic usage is characterized by transmissions of 30-60 seconds or more, the overall performance of the system quickly becomes degraded. Likewise, operational users of the systems are not accustomed to long transmission or turnaround delays; in fact, public safety operations are generally intolerant of such delays.

SPECIAL data will not be able to be accommodated on a wholesale basis until its transfer times are comparable to query type data in most systems or in a worst case, comparable to the typical voice transmission length in those lightly loaded systems. This is an important point that is often overlooked in the current euphoria over technology. Of course, should dramatic advancements in compression techniques make SPECIAL data more manageable, current and emerging state-of-common usage systems can then be effectively exploited for this type of teleservice.

Given the operational requirements of the vast majority of public safety user agencies, we assert the primary usages of current public safety systems will be to transport voice, status/message and file query data. In this regard the metrics presented have been further refined to focus on these primary services.

In an attempt to understand the broad applicability and utility of this profile, we have created sub-categories such as voice and data for hazardous materials and for EMS communications. Also identified in a separate sub-category is a very common communications mode that is often overlooked: car-to-car or unit-to-unit traffic. Many federal, state, and local law enforcement and Public Safety operations including Fire Ground, etc. make extensive use of this tactical unit-to-unit communications modality.

Heeding the advice of many commentators on our previous traffic profile work, we have avoided the double counting aspect of this tactical unit-to-unit operational modality. This issue arose as most of the unit-to-unit traffic is typically “off-infrastructure” on a simplex channel not going through a mobile relay. Occasional unit-to-unit communications, which use a mobile relay, can be accommodated through the remaining categories.

It is our intent to present a universal traffic profile and metric amalgamation. From a user needs and requirements point-of-view, we believe that the traffic profile should be broadly applicable to both conventional and trunked environments and scaleable to address small and large system usages.

In this regard, we are unable to subscribe to the notion that specifics given for control traffic loading and usage are user requirements or are representative of a user offered load. We therefore do not include values which are illustrative and applicable to a particular trunking technology implementation solution. Thus, how much trunking control load is imposed in a particular system implementation to service the user profile we have advanced here-in is NOT addressed. In this regard, it is our position that control channel load is the effect caused by a certain user loading and will vary depending upon the specific technical solution applied.

Likewise, we have not included any references to implementation solutions such as transmission or message trunking or any reference to fringe area retransmission or retry factors. Nor have we included any multi-site load factors as they appear to assume that the average user may be generalized to a multi-site system. In addition, the selection of multi-site factor(s) is technology solution dependent and this is not representative of a user defined load.

Furthermore, the fact that we have presented a unified metric means that we are generalizing that all Public Safety users employ voice, data and status. This assertion is somewhat is problematic to us as our experience has shown that there is a very wide diversity in data and status usage amongst public safety users.

We have therefore chosen to present the offered data in both aggregate total offered load and in decomposed format segregating the voice, data and status loading. In the future, we believe that most but not all Public Safety users will employ some form of data, be it status and or messaging. Thus for simulation purposes we strongly recommend employing the unified aggregate load figures for projected future usage.

The traffic profiles provided represent discrete and composite values for both current and projected future usages for a hypothetical Law Enforcement/Public Safety organization employing both digital voice and digital multimedia services. The current traffic profile was developed from an aggregation of federal, state and local law enforcement data. The future profile was based upon the current aggregation along with projections of future data usage. The assumptions and predicates for these profiles are declared. These composite traffic profiles are presented to serve as a comparative baseline to assess the performance of advanced digital trunked systems in law enforcement/public safety usage. This composite traffic profile is not meant to serve as an absolute design criteria for any specific user agency or activity.

We acknowledge the need however, for a standard traffic profile. The traffic profiles offered in this document may be used for system modeling, simulation and design purposes for both current and projected usages. However, it is incumbent upon all designers and system operators to regularly collect and analyze the actual usage statistics of their respective systems. Certain user agencies may find our profiles are too conservative, while others may find we have underestimated the real load. Over time, on a continual and regular basis, the specific system performance must be evaluated. If excessive blocking and access delays occur, steps must be taken to correct for these occurrences. Likewise, if the grade-of-service is significantly better than the design objective, additional officer traffic may likely be accommodated.

We advocate a technically sound common sense approach to system optimization be institutionalized in both trunked and conventional environments. Recognizing that past statistical trends may be useful for certain forecasting where the operational imperatives remain constant. Unfortunately, natural and manmade disasters will impose severe demands on any conventional or trunked system in a fashion that is radically different from “routine” emergency peak loading. Proactive planning, and not our traffic profiles is needed to assure system availability in times of catastrophic events.

TRANSACTION CLASSIFICATION DEFINITIONS:

The traffic profiles tables provided in the attachments tabulate the types of transactions supported by public safety wireless communications systems. General categories such as Teleservice, are employed to define the types of information being transported. These transactions are grouped into the following three categories:

Digital Voice: Those actions that relate to the use of system resources needed to handle calls related to information transfer via voice and contribute to the aggregate communications system channel information transfer rate and load. Voice traffic is generally passed via a working channel that is either dedicated for voice transport or is shared with supervisory and/or status/message data.

Data: Those actions that relate to the use of system resources needed to handle calls related to information transfer via non-voice means and contribute to the aggregate communications system channel information transfer rate and load. Data traffic is generally passed via a working channel that is either dedicated for message data transport or is shared with supervisory data and/or voice traffic. Data traffic may be transported through both circuit switched and packet mechanisms. It is assumed for this analysis that all data are packetized, confirmed delivery except for slow scan imagery, which is presumed to be circuit switched. SPECIAL DATA has been segregated from the projected future offered load and presented separately. Its impact is NOT considered in the recommended future projected load values.

Status/Message: Those actions that relate to the use of system resources needed to handle the transfer of information which indicates status change, or provide for equally short message data, of the subscriber or infrastructure. This occurs without producing any specific response either through non-voice means, but contributes to the aggregate communications system channel information transfer rate and load. Status/message traffic may be passed on a working channel or may be passed on a control channel depending upon the specific system implementation. It is anticipated that most if not all Status/Message traffic will be conveyed via packet means.

Activities in each of the three categories contribute to the total user-defined load of a system. The characterization of the traffic load thus must consider certain elements which are:

Number of Transmissions: The number of transmissions per activity. An activity that is completed is a "message." Some number *n* of transmissions would comprise a complete "message". In this case we are not using the term "message" but rather are identifying the number of transmissions required to effect a specified activity. This number of transmissions is referred to as *Tn*.

Duration of Transmissions: In addition to the number of transmissions *Tn*, the duration of the transmission is also a load determining element. Duration of the transmission is defined in seconds and is represented by the term *Td*.

Number of Calls per Average Busy Hour: In addition to the two elements addressed, the third load determining element is the number of transmissions the Public Safety officer is involved in per hour that results in the associated transmissions. This element is expressed by the term *M*.

From this information the offered load, in Erlangs (*E*) can be determined and is calculated by the following expression:

Offered Load in Erlangs = (*Tn* x *Td* x *M*)/3600.

2. PUBLIC SAFETY OFFICER TRAFFIC PROFILE SUMMARY:

Our data indicate that the busy hour itself is highly variant. Thus, we have elected to recommend that an average busy hour load factor be employed that is approximately four times (4X) as busy as the average non-busy hour. Thus the Average Busy Hour appears to effectively consider routine peak traffic loads. Of course, emergency loading is not considered in this analysis. Typically under emergency conditions, loading may increase by a factor of ten or more.

The summary of offered traffic load per Public Safety officer is as follows:

Present Requirements Summary (Average Busy Hour):

Transaction Type	Inbound Erlangs	Outbound Erlangs
Voice (Digital)	0.0073484	0.0462886
Data	0.0004856	0.0013018
Status/Message	0.0000357	0.0000232

Present Busy Hour Traffic Load Per Officer: 0.0554832

Present Requirements Summary (Average non-Busy Hour "25% of Busy Hour"):

Transaction Type	Inbound Erlangs	Outbound Erlangs
Voice (Digital)	0.0018371	0.0115722
Data	0.0001214	0.0003254
Status/Message	0.0000089	0.0000058

Present Average Hour Traffic Load Per Officer: 0.0138708

Future Requirements Summary (Average Busy Hour):

Transaction Type	Inbound Erlangs	Outbound Erlangs
Voice (Digital)	0.0073284	0.0463105
Data	0.0030201	0.0057000
Status/Message	0.0001540	0.0002223

Future Busy Hour Traffic Load Per Officer: 0.0627354

Future Requirements Summary (Average non-Busy Hour):

Transaction Type	Inbound Erlangs	Outbound Erlangs
Voice (Digital)	0.0018321	0.0115776
Data	0.0007550	0.0014250
Status/Message	0.0000385	0.0000556

Future Average Hour Traffic Load Per Officer: 0.0156838

SPECIAL DATA Future Requirements Summary (Average Busy Hour):

Inbound Erlangs	Outbound Erlangs
0.0268314	0.0266667

Future SPECIAL Data Traffic Load Per Officer: 0.053498

SPECIAL DATA Future Requirements Summary (Average non-Busy Hour):

Inbound Erlangs	Outbound Erlangs
0.0067078	0.0066667

Future SPECIAL Data Traffic Load Per Officer: 0.0133745

What do these data indicate? Firstly, that the use of data in the future will significantly impact system design and use. Secondly, consider the practical translation of the above. If one Erlang is equivalent to 3600 seconds, then in a one hour period a Public Safety officer would use his/her communications equipment (transmit and receive) for the following durations:

Present Busy Hour (0.0554832 Erlangs or 200 seconds)

200 seconds or 3.3 minutes of airtime per officer per busy hour

(If a 5 second average voice transmission is assumed, with a typical message being comprised of three five (5) second transmissions, then 3.3 minutes equates into 13 messages per hour excluding multimedia data usage.)

Present Non-Busy Hour (0.0138708 Erlangs or 50 seconds)

50 seconds per officer of airtime per officer per non-busy hour

(If a 5 second average voice transmission is assumed, with a typical message being comprised of three five (5) second transmissions, then 50 seconds equates into 3.3 messages per hour excluding multimedia data usage.)

Future Busy Hour (0.0627354 Erlangs or 226 seconds)

226 seconds or 3.7 minutes of airtime per officer per busy hour

(If a 5 second average voice transmission is assumed, with a typical message being comprised of three five (5) second transmissions, then seconds equates into 15 messages per hour excluding multimedia usage.)

Future Non-Busy Hour (0.0156838 Erlangs or 56.5 seconds)

56 seconds of airtime per officer per non-busy hour

(If a 5 second average voice transmission is assumed, with a typical message being comprised of three five (5) second transmissions, then 56 seconds equates into 3.7 messages per hour excluding multimedia usage.)

SPECIAL DATA: Future non-Busy Hour (0.0133745 Erlangs or 48 Seconds)

SPECIAL DATA: Future Average Busy Hour (0.053498 Erlangs or 193 Seconds)

3. GRADE OF SERVICE (GOS), PRIORITY and RESPONSE TIME:

Grade of Service:

We are recommending that the GOS employed for the standard evaluation of Public Safety trunked and conventional system performance be one call for service per one hundred attempts during the average busy hour, is blocked and that the blocked call be held in queue for a period not to exceed five seconds. This results in a GOS being defined as P.01 for the average busy hour.

We are additionally recommending that the Erlang-C traffic equation be employed in determining the Service Grade in conjunction with an assumption that the call arrival rate follows a Poisson distribution.

However, not withstanding this recommendation, it is important to note that today's public safety trunked systems typically operate with a Busy Hour Grade of Service of P.1, meaning that during a busy hour typically 90% of the calls get through with no delay and 10% being delayed for five seconds or less.

What we are recommending is a transition from a GOS of P.1 to P.01. It is our opinion that average busy hour blocking should not impact more than one call per hundred.

Priority:

In addition, we recommend that only two priority types be recognized for baseline comparative purposes: Routine and Emergency.

We suggest that during normal usage ALL Public Safety officers be treated with equal routine operational priority. The only time routine operations priority would be overridden is during an "EMERGENCY". Emergency priority, in our view, results in the ability to "seize" system resources under all circumstances.

Response Time:

In the case of packetized Data and Status/message transmission the notion of GOS is problematic. We believe that Data and Status/message performance is best reflected in terms of a statistically expressed response time. In this regard, we propose that all Data and Status/message messages be received 99% of the time at the following response times assuming a information transport rate of 750 B/s:

SPECIAL DATA

Large Data Message (30 KBytes) 40,000 ms

NON-SPECIAL DATA

Moderate Data Message (5 KBytes) 6,666 ms

Small Data Message (2.4 KBytes) 3,200 ms

Status/Message 600 ms

Note: For bearer service, circuit switched data usages, the GOS metric would be applicable as the channel resource is seized until the transaction is completed.

The response times are consistent with a current public safety state-of-common usage technology which has a total payload information transfer rate of approximately 6,000 bits-per-second (b/s) or 750 Bytes-per-second (B/s) including all overhead and turn-around times for half duplex acknowledgment and represent(s) a significant i.e., two fold (2x) improvement in information transfer either in terms of duration (half the time) or content (twice the data) as compared to current 4800 b/s analog systems nominal payload data rates. Compared to those analog systems operating at a 9600 b/s gross rate, the information transport rate of 6,000 b/s (750 B/s) is comparable if not better than that achieved in current analog practice.

4. TRAFFIC MODEL RECOMMENDATION:

Public safety communications traffic loading is typified by large peak-to-mean variations. Typically we have found that average busy hour traffic is at least four (4) times the average non busy hour.

In addition, as stated, it is unacceptable for Public Safety users to be denied service. If system resources are busy, all Public Safety users must be held in queue and assigned a resource as it becomes available. The exception is in an emergency where we recommend that an emergency call seize whatever system resource is needed. This recommendation is discussed further under our coverage on priority usage.

We therefore recommend that the GOS for a Public Safety trunked system be determined through the use of the Erlang-C delay model which is based upon the following predicates:

- The offered load follows a Poisson arrival process
- Service times are exponential
- The load source is infinite
- A FIFO queue is utilized
- A single server queue is employed, calls are directed to the first available server or trunk
- No calls leave the queue
- An infinite queue is available
- Average busy hour to non-busy hour ratio of 4-1

<u>The Poisson traffic equation is expressed as follows:</u>

$$P = e^{-y} \sum_{x=n}^{\infty} (y^x/x!)$$

where:

P = probability of blocking

n = number of trunks or channels

y = traffic offered in Erlangs

The Erlang-C delay model is expressed as follows:

$$w = \frac{t(y)^{n+1} P_o}{y(n-1)!(n-y)^2}$$

where:

$$P_o = \frac{1}{\sum_{x=0}^{n-1} \frac{1}{x!}(y)^x + \frac{1}{n!}(y)^n \left(\frac{n}{n-y}\right)}$$

w = mean wait time in queue in seconds

n = number of trunks or channels

y = Traffic offered in Erlangs

t = mean message duration in seconds which is the reciprocal of the mean message servicing rate

5. IMPACT ON PART 90 LOADING REQUIREMENTS

A word of caution is in order concerning the use of traffic profiles in general: The adoption of any traffic profile for the evaluation of conventional or trunked systems may be in direct conflict with FCC Rules and Regulations. Part 90 specifies conventional and trunked loading as a function of the number of licensed units assigned to a given channel. Thus if 100 units are required per channel, a twenty channel trunked system must have 2000 subscriber sets licensed to it.

We have attempted to present a comparison of our future traffic loading findings and the loading requirements enumerated in Part 90. In this regard, we have assumed a GOS of P.1 (10% blocking) in the average busy hour. Using a baseline 20 channel trunked system that employs one channel for control, we have used the Poisson Traffic table to infer the offered load of 2000 units on 19 trunks (channels) at a GOS of P.1. Nineteen (19) trunks at a P.1 GOS can support 13.65 Erlangs of traffic. Distributed across 2000 units, each unit has an inferred load of approximately .0068 Erlangs.

We believe that in the Public Safety environment, officer safety and mission effective communications demand that sound traffic engineering principles and practices be followed in the design of either a trunked or conventional voice or data or combined system(s). In the United States there is precedent for this in terms of the Part 22 Common Carrier trunked system loading and engineering standards. This recommendation is applicable BOTH to conventional (i.e., non-trunked) and trunked systems.

6. HYPOTHETICAL SYSTEM EXAMPLE OF PROPOSED FUTURE USAGE

Let us consider a hypothetical system that has traffic characterized by our proposed future usage metrics. Let us further assess the performance of the system in context of the P.01 (one call per 100 is blocked) GOS recommendation.

Consider the following configuration:

Number of channels (including control)	20
Number of Trunks	19
Erlangs Supported on 19 trunks	10.35
Recommended GOS	P.01
Future Average Busy Hour Load per user	0.0627354E
Future Average Hour Load per user	0.0156838E

The question then is how many users can the system support using these parameters?

Referring to a traffic table one finds that 19 trunks at a GOS of P.01 can handle 10.35 Erlangs of traffic. Given our assumption that each user generates 0.0627354 Erlangs per hour, a total of (10.35/0.0627354) 165 users can be supported. At a reduced GOS of P.1 (10 out of 100 calls will be blocked), 19 trunks supports 13.65 Erlangs of traffic which supports 218 users. This analysis reveals an apparent inconsistency with Part 90 which requires that 20 channels (irrespective of control channel usage) have 2000 licensed users.

The values are depicted in the following table:

FUTURE USAGE (AVERAGE BUSY HOUR)

GOS	#Units Supported	Assumed Offered Load/Unit	Airtime Per Unit Per Hour
P.01	165	0.0627354	226 Seconds (3.8 Min.)
P.1	218	0.0627354	226 Seconds (3.8 Min.)

In the case of Average Hour (NONBUSY) the number of units supported are as follows:

FUTURE USAGE (AVERAGE HOUR)

GOS	#Units Supported	Assumed Offered Load/Unit	Airtime Per Unit Per Hour
P.01	660	0.0156838	56 Seconds
P.1	870	0.0156838	56 Seconds

As one can see these values are less than the loading prescribed in Part 90 assuming that the quantity of licensed units and units actually in service at a given point-in-time, are the same. The following table summarizes the Part 90 offered load for both P.01 and P.1 GOS, during the Average BUSY Hour:

FCC PART 90 LOADING
(Hypothetical 20 Channel Trunked System)

GOS	#Units Supported	Assumed Offered Load/Unit	Airtime/Unit/Hour
P.01	2000	0.0052 E	18.7 Seconds
P.1	2000	0.0068 E	24.5 Seconds

Thus, the Part 90 inferred offered load appears to be significantly less than our present day busy-hour and projected future non-busy and busy hour metrics.

In an attempt to evaluate the Part 90 inferred offered load of 0.0068E or 24.5 seconds with our projected average busy hour offered load metric of 0.0138708E or 50 seconds, we looked for obvious areas of usage that did not exist with the Part 90 standards were developed. We focused on three areas: Tactical Voice, Data and Status:

If we back-out the contribution of Tactical VOICE, DATA and STATUS from our future projected offered load metrics we see that the 0.0138708E offered load reduces by (0.010416675E tactical VOICE, 0.00032545E extracting the DATA, and by 0.0000058E extracting the STATUS for a total reduction in offered load of 0.010747925E) resulting in an adjusted voice only system load of 0.003122875E (11.24 seconds). This value is much less than the Part 90 inferred value of .0068E (24.5 Seconds) based upon “current” non-busy hour usage.

However, during a present day busy hour, the traffic increased by a factor of four (4) resulting in a corrected load of 0.0124915E (45 Seconds) (excluding the tactical voice, data and status messages).

In the future, the situation appears to be more complicated where both non-busy and busy hour loads are anticipated to be significantly greater characterized by extensive combined digital voice, data and status traffic. In addition, the tactical voice modality is a current reality which is likely to proliferate in the future.

Notwithstanding these facts, one may conclude that the loading values established in Part 90 based upon a non-busy hour GOS of P.1 (10% blocking) was reasonable when considering traditional dispatch voice traffic during the non-busy hour.

It is important to keep in mind the fact that although examples provided are illustrative of trunked systems, the same issues face designers, operators and users of conventional or composite conventional systems. Each trunk (functional channel) can support only a certain traffic load for a prescribed grade-of-service. Proper system engineering demands that user loading be considered in all types of systems (trunked, composite conventional, conventional) and for all types of usage (digital voice, data and status).

7. NOTES TO PROPOSED TRAFFIC PROFILE METRICS

The following are notes applicable to the traffic profile metrics attached to this document as Appendix A:

Note 1:
These values represent an amalgamation of state, local, federal, and international data. In those areas where no information different from the initial Ericsson proposal was available, the Ericsson data remain.

Future projections were based upon logical extrapolations of current usage.

Note 2:
These values are representative of an amalgamation of state, local, federal, and international data. In those areas where no information different from the initial Ericsson proposal was available, the Ericsson data remain.

Future projections were based upon logical extrapolations of current usages. Certain new services considered NCIC-2000 type technologies and large file size multimedia, information transfer rate intensive technologies.

Note 3:
The emerging use of SPECIAL DATA presents major concern, as seen above, SPECIAL DATA will likely increase the offered load by 48 seconds per user in the average hour and by

193 seconds in the busy hour. Clearly these increases in offered load are NOT supportable by currently deployed technology.

As technological advancements occur in compression methodologies that permit large data messages and slow scan imagery to be transmitted in shorter times, the impact on system loading will be dramatically decreased. However, it is important to note that new technologies such as the wireless transmission of telephoto (mug shot), fingerprint and imagery, employing today's compression techniques, will require significant transmission times. If user operational requirements PROJECT significant usage of these large data files sharing with tactical voice may result in unacceptably long delays.

We recommend that SPECIAL DATA be transported by means of technologies and systems specifically engineered to handle its information transfer rate intensive nature in a fashion that provides response time equivalency to today's status, message and database query usages. This is because operational users have certain expectations as to how long data queries should take. To foster user acceptance and to constrain system loading, we assert multimedia transmission and transport times should be comparable to those of current data usages. Thus, information transfer rates in the high kb/s to low Mb/s range will likely be required depending upon the compressed file size in order to provide response times comparable to current status message data usage.

APPENDIX A

Aggregated Public Safety Communications User

TRAFFIC PROFILES

25 MAY 1995
(reprinted 13 March 1996)

PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE PRESENT REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0073484	0.0462886
DATA	0.0004856	0.0013018
STATUS	0.0000357	0.0000232
Resulting Subscriber Busy Hour Traffic Loading	0.0078696	0.0476136
	TOTAL	0.0554832

PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0073284	0.0463105
DATA	0.0030201	0.0057000
STATUS	0.0001540	0.0002223
Resulting Subscriber Busy Hour Traffic Loading	0.0105026	0.0522328
	TOTAL	0.0627354

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE PRESENT REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0018371	0.0115722
DATA	0.0001214	0.0003254
STATUS	0.0000089	0.0000058
Resulting Subscriber Average Hour Traffic Loading	0.0019674	0.0119034
	TOTAL	0.0138708

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY	Inbound Erlangs	Outbound Erlangs
VOICE	0.0018321	0.0115776
DATA	0.0007550	0.0014250
STATUS	0.0000385	0.0000556
Resulting Subscriber Average Hour Traffic Loading	0.0026256	0.0130582
	TOTAL	0.0156838

PUBLIC SAFETY OFFICER AVERAGE BUSY HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY (SPECIAL DATA)	Inbound Erlangs	Outbound Erlangs
SPECIAL DATA	0.0268314	0.0266667
Resulting Subscriber Busy Hour Traffic Loading	0.0268314	0.0266667
	TOTAL	0.053498

PUBLIC SAFETY OFFICER AVERAGE HOUR TRAFFIC PROFILE FUTURE REQUIREMENTS SUMMARY (SPECIAL DATA)	Inbound Erlangs	Outbound Erlangs
SPECIAL DATA	0.0067078	0.0066667
Resulting Subscriber Busy Hour Traffic Loading	0.0067078	0.0066667
	TOTAL	0.0133745

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

		Traffic Channel Loading							
TELESERVICES	**OPERATIONS**	INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
VOICE (Note 1)									
Group	Special Info/Assign	2	2.00	1.260	0.0014000	2	2.00	1.385	0.0015385
	Medical Detail	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Bomb/Explosive Alert	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Conduct Investigation	2	2.00	0.210	0.0002333	2	2.00	0.231	0.0002564
Individual	Special Info/Assign	2	4.80	0.840	0.0022400	2	2.50	0.923	0.0012821
	Medical Detail	2	2.50	0.019	0.0000259	2	1.25	0.021	0.0000142
	Conduct Investigation	2	4.80	0.105	0.0002800	2	2.50	0.115	0.0001603
	Traffic Report	2	2.50	0.210	0.0002917	2	1.25	0.210	0.0001458
	Bomb/Explosive Alert	2	2.50	0.005	0.0000065	2	1.25	0.005	0.0000032
	Emergency	2	2.50	0.009	0.0000130	2	1.25	0.009	0.0000065
	Vehicle Report	2	6.00	0.525	0.0017500	2	2.50	0.525	0.0007292
	Persons Report	2	6.00	0.315	0.0010500	2	2.50	0.315	0.0004375
Broadcast	Special Info/Assign	1	3.00	0.009	0.0000078	1	6.00	0.009	0.0000156
	Emergency	1	3.00	0.004	0.0000029	1	6.00	0.004	0.0000058
	Bomb/Explosive Alert	1	3.00	0.005	0.0000039	1	1.00	0.005	0.0000013
Hazardous Material		2	2.00	0.0004	4.44E-07	2	2.00	0.004	0.0000044
EMS Control and General	Public Safety Reports	2	10.00	0.0004	2.22E-06	2	10.00	0.004	0.0000222
PSTN	Special Info/Assign	2	10.00	0.0000100	0.0000001	2	12.00	0.0000100	0.0000001
Unit-to-Unit	Tactical	0	0.00	0.000	0	3	20.00	2.500	0.041667

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading INBOUND Tn	Td	M	OFFERED LOAD (erlangs)	OUTBOUND Tn	Td	M	OFFERED LOAD (erlangs)
Total Contributions		33	70.60	3.535	0.0073284	36	80.00	6.283	0.0463105
DATA (Note 2)									
Hazardous Material		1	1.00	0.004	0.0000011	1	1.00	0.004	0.0000011
EMS Control and General	Public Safety Reports	1	5.00	0.004	0.0000056	1	5.00	0.004	0.0000056
	Missing	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
	Unidentified	1	0.80	0.270	0.0000600	2	2.40	0.270	0.0003600
Stolen Articles	License Plate	1	0.80	0.135	0.0000300	2	2.40	0.135	0.0001800
	Serial Number	1	0.80	0.036	0.0000081	2	2.40	0.036	0.0000486
	Identification Number	1	0.80	0.090	0.0000201	1	2.40	0.090	0.0000603
Alarm Compliance	Burglary	1	0.80	0.036	0.0000081	1	2.40	0.036	0.0000243
	Ringing	1	0.80	0.018	0.0000039	1	2.40	0.018	0.0000117
	Vandalism	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
	Robbery	1	0.80	0.068	0.0000150	1	2.40	0.068	0.0000450
For Information (FI)	Suspicious Persons	1	2.40	4.000	0.0026667	1	4.00	4.000	0.0044444
Addr/Tel Info (ATI)	Suspicious Persons	1	1.60	0.386	0.0001716	1	4.00	0.386	0.0004290
Voiceless Dispatch	(see voice)								
Total Contributions		13	17.20	5.183	0.0030201	16	35.60	5.183	0.0057000

Public Safety Officer
Busy Hour Traffic Profile
FUTURE REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading INBOUND Tn	Td	M	OFFERED LOAD (erlangs)	OUTBOUND Tn	Td	M	OFFERED LOAD (erlangs)
STATUS	Special Info/Enroutes	1	0.03	6.000	0.0000500	1	0.03	3.000	0.0000250
	Network Management	1	0.80	0.420	0.0000933	1	1.60	0.420	0.0001867
SYSTEM CONTROL									
Security	Registration								
	Authentication	1	1.03	0.009	0.0000027	1	1.03	0.009	0.0000027
	Corroboration	1	3.09	0.009	0.0000080	1	3.09	0.009	0.0000080
Total Contributions		4	4.95	6.439	0.0001540	4	5.75	3.439	0.0002223

TELESERVICES SPECIAL DATA	OPERATIONS	INBOUND Tn	Td	M	OFFERED LOAD (erlangs)	OUTBOUND Tn	Td	M	OFFERED LOAD (erlangs)
Slow Scan		1	100.00	0.060	0.001667	1	100.00	0.060	0.0016667
Images	Mugshot	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
	Fingerprint	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
	Object ID	1	30.0	1.000	0.0083333	1	30.0	1.000	0.0083333
Total Contributions		4	190.00	3.060	0.0268314	4	190.00	3.060	0.0266667

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading INBOUND Tn	Td	M	OFFERED LOAD (erlangs)	OUTBOUND Tn	Td	M	OFFERED LOAD (erlangs)
VOICE (Note 1)									
Group	Special Info/Assign	2	2.00	1.260	0.0014000	2	2.00	1.385	0.0015385
	Medical Detail	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Bomb/Explosive Alert	2	2.00	0.009	0.0000104	2	2.00	0.009	0.0000104
	Conduct Investigation	2	2.00	0.210	0.0002333	2	2.00	0.231	0.0002564
Individual	Special Info/Assign	2	4.80	0.840	0.0022400	2	2.50	0.923	0.0012821
	Medical Detail	2	2.50	0.019	0.0000259	2	1.25	0.021	0.0000142
	Conduct Investigation	2	4.80	0.105	0.0002800	2	2.50	0.115	0.0001603
	Traffic Report	2	2.50	0.210	0.0002917	2	1.25	0.210	0.0001458
	Bomb/Explosive Alert	2	2.50	0.005	0.0000065	2	1.25	0.005	0.0000032
	Emergency	2	2.50	0.009	0.0000130	2	1.25	0.009	0.0000065
	Vehicle Report	2	6.00	0.525	0.0017500	2	2.50	0.525	0.0007292
	Persons Report	2	6.00	0.315	0.0010500	2	2.50	0.315	0.0004375
Broadcast	Special Info/Assign	1	3.00	0.009	0.0000078	1	1.00	0.009	0.0000026
	Emergency	1	3.00	0.004	0.0000029	1	1.00	0.004	0.0000010
	Bomb/Explosive Alert	1	3.00	0.005	0.0000039	1	1.00	0.005	0.0000013
Hazardous Material		2	2.00	0.0004	4.444E-07	2	2.00	0.0004	4.444E-07
EMS Control and General	Public Safety Reports	2	10.00	0.004	2.222E-05	2	10.00	0.004	2.222E-05
PSTN	Special Info/Assign	2	7.20	0.0000100	0.0000000	1	7.20	0.0000100	0.0000000

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading INBOUND Tn	Td	M	OFFERED LOAD (erlangs)	OUTBOUND Tn	Td	M	OFFERED LOAD (erlangs)
Unit-to-Unit	Tactical	0	0.00	0.000	0	3	20.00	2.500	0.0416667
Total Contributions		33	67.80	3.538	0.0073484	35	65.20	6.279	0.0462886
DATA (Note 2)									
Hazardous Material		1	1.00	0.004	0.0000011	1	1.00	0.004	0.0000011
EMS Control and General	Public Safety Reports	1	5.00	0.004	0.0000056	1	5.00	0.004	0.0000056
	Missing	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
	Unidentified	1	0.80	0.200	0.0000444	2	2.40	0.200	0.0002667
Stolen Articles	License Plate	1	0.80	0.100	0.0000222	2	2.40	0.100	0.0001333
	Serial Number	1	0.80	0.027	0.0000060	2	2.40	0.027	0.0000360
	Identification Number	1	0.80	0.067	0.0000149	1	2.40	0.067	0.0000447
Alarm Compliance	Burglary	1	0.80	0.027	0.0000060	1	2.40	0.027	0.0000180
	Ringing	1	0.80	0.013	0.0000029	1	2.40	0.013	0.0000087
	Vandalism	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
	Robbery	1	0.80	0.050	0.0000111	1	2.40	0.050	0.0000333
For Information (FI)	Suspicious Persons	1	2.40	0.333	0.0002220	1	4.00	0.333	0.0003700
Addr/Tel Info (ATI)	Suspicious Persons	1	1.60	0.286	0.0001271	1	4.00	0.286	0.0003178
Voiceless Dispatch	(see voice)								
Total Contributions		13	17.20	1.211	0.0004856	16	35.60	1.211	0.0013018

Public Safety Officer
Busy Hour Traffic Profile
PRESENT REQUIREMENTS

TELESERVICES	OPERATIONS	Traffic Channel Loading							
		INBOUND				OUTBOUND			
		Tn	Td	M	OFFERED LOAD (erlangs)	Tn	Td	M	OFFERED LOAD (erlangs)
STATUS	Special Info/Enroutes	1	0.03	3.000	0.0000250	1	0.03	1.500	0.0000125
SYSTEM CONTROL									
Security	Registration								
	Authentication	1	1.03	0.009	0.0000027	1	1.03	0.009	0.0000027
	Corroboration	1	3.09	0.009	0.0000080	1	3.09	0.009	0.0000080
Total Contributions		3	4.15	3.019	0.0000357	3	4.15	1.519	0.0000232

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment by the Spectrum Policy Task Force	)	ET Docket No. 02-135
	)	
	)	
	)	

To: The Commission

COMMENTS OF

Statewide Wireless Network

New York State Office for Technology

6C Executive Park Dr.

Albany, NY 12203-3716

July 8, 2002

Appendix 7

Cover Letter, and Slides presented to the FCC Public Safety National Coordination Committee meeting in San Francisco, CA on January 28, 2000

JAMES W. McMAHON
SUPERINTENDENT

STATE OF NEW YORK
NEW YORK STATE POLICE
BUILDING 22
1220 WASHINGTON AVENUE
ALBANY, NEW YORK 12226-2252

April 3, 2000

Ms. Kathleen Wallman
Wallman Strategic Consulting, LLC
555 12th Street, NW
Washington, DC 20004

Dear Ms. Wallman:

At the January 28, 2000, meeting of the Federal Communications Commission's Public Safety National Coordination Committee, held at City Hall in San Francisco, California, I was given the opportunity to present slides which illustrate the adverse impact of the proposed Canadian Digital Television Allotment Plan upon Public Safety users of the 764-776 / 794-806 MHz band. Enclosed is a printed copy of that presentation.

To provide you with further information regarding the adverse impact of this situation, but not to burden you with additional paper, I recommend that you review the material publicly available on the Internet web site of Hammett and Edison, Consulting Engineers, at <http://www.h-e.com>. A copy of the items to review on their home page is enclosed. Chief among these is the November 15, 1999 draft Letter of Understanding between Industry Canada and the Federal Communications Commission, along with all of its appendices. This document excludes Public Safety along the border from any rights to the 700 MHz Public Safety band. You will note that the broadcasting group they represent also has problems with this plan. That report explains where they obtained a copy of the draft Letter of Understanding.

Last Friday we met with Public Safety representatives of Washington State agencies, the City of Seattle, the City of Portland Oregon and Washington County, Oregon - already well known for their interference problem with NEXTEL. We discussed the impact of this problem upon them, and they are also very concerned, even though they would have a much lower number of DTV allotments to impact them, it directly affects their major population areas along the coast.

A review of the entire US border with Canada reveals that there is an extreme concentration of adversely impacting DTV allotments in the Northeast. The Canadian Allotment Plan is totally unsatisfactory to New York State and will seriously impact the other Northeast border States from Maine to Michigan, along with Washington and Oregon.

As the Committee Chair and Chief Spokesperson for Public Safety in the United States, we seek your assistance in guiding the Commission toward a more appropriate international agreement that will not diminish Public Safety use of this Congressionally mandated spectrum relief.

If you should have any questions, please do not hesitate to contact me at (518) 457-9478.

Sincerely,

Robert F. Schlieman
Radio Engineer
New York State Police

Encl. (2)

C: NCC Members
Douglas M. Aiken
Clarence Harmon
Ernest Hofmeister
Harlin R. McEwen
Timothy Loewenstein
Julio Murphy
Ellen O'Hara
Stephen Proctor
Louise Renne
Marilyn Ward
Designated Federal Officer
Michael Wilhelm

Available From Hammett & Edison web site <http://www.h-e.com/logo.html>:

February 7, 2000	**Preliminary evaluation of Canadian DTV Letter of Understanding. [2548 kB]**
January 17, 2000	**List of Canadian DTV allotments short-spaced to U.S. NTSC stations and DTV allotments. [389 kB]**
> January 12, 2000	**Canadian DTV Agreement * (not yet ratified) [712 kB]**

* = **Nov. 15, 1999 Draft Letter of Understanding, Includes All Appendices**

The Following slides were presented to the FCC Public Safety National Coordination Committee at their San Francisco meeting on January 28, 2000.

Robert F. Schlieman
New York State Police
1220 Washington Avenue - Bldg 22
Albany, New York 12226-2252
Telephone: (518) 457-9478

Impact of the current Canadian Digital Television Transition Allotment Plan, Issue 2, April 1999, upon United States Public Safety use of the 764-776/794-806 MHz band in the New York State area. TV channels 62, 63, 64, 65, 67, 68 and 69

Robert F. Schlieman, NYSP

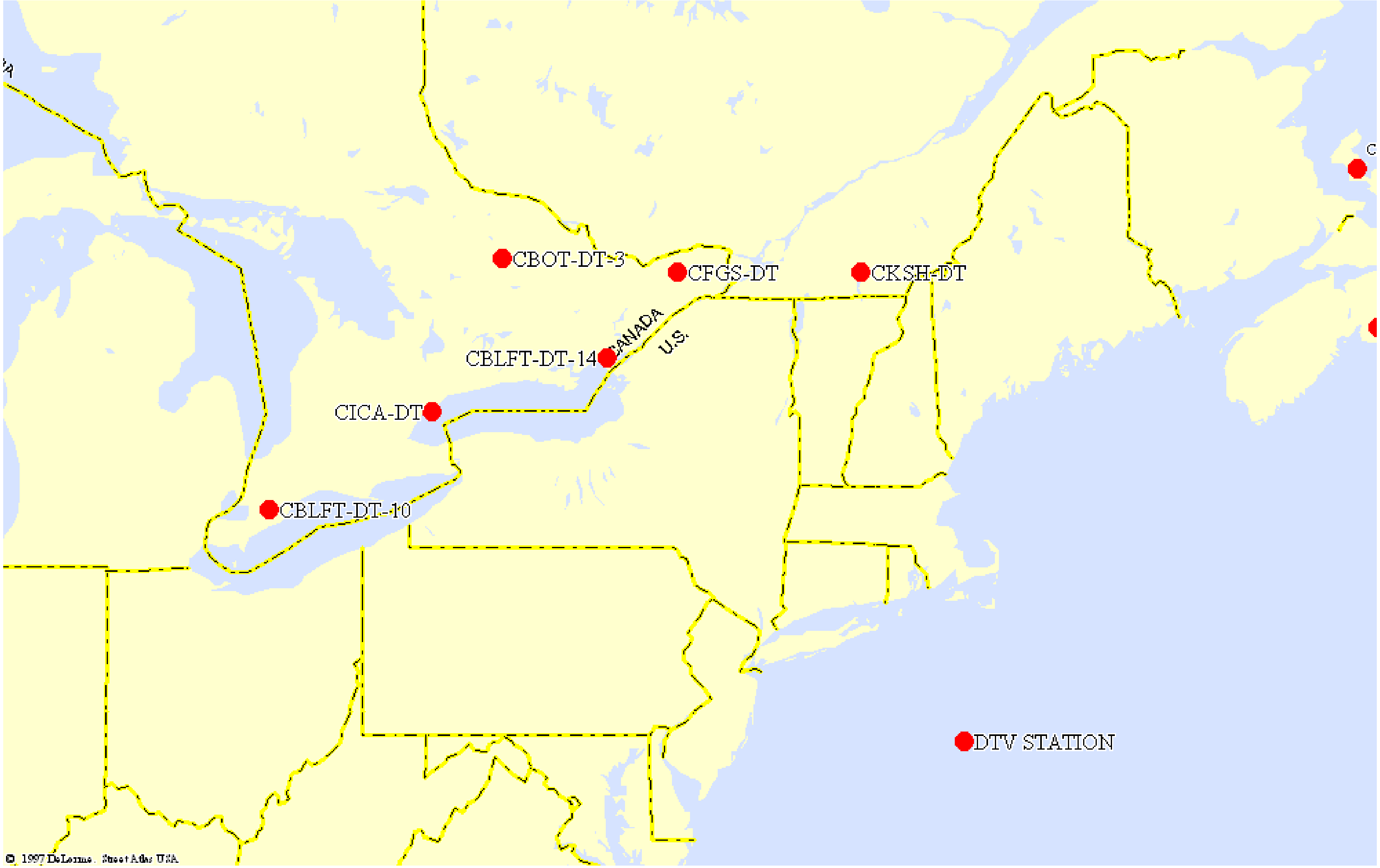
Presented at the PSWN Symposium in Lansing, Michigan

September 23, 1999

Channel 62


UNITED STATES
CBOFT-DT
CKNX-DT
CKWS-DT-1
CANADA
U.S.
© 1997 DeLorme Street Atlas USA

Channel 63


CBOT-DT-3
CFGS-DT
CKSH-DT
CANADA
U.S.
CBLFT-DT-14
CICA-DT
CBLFT-DT-10
DTV STATION
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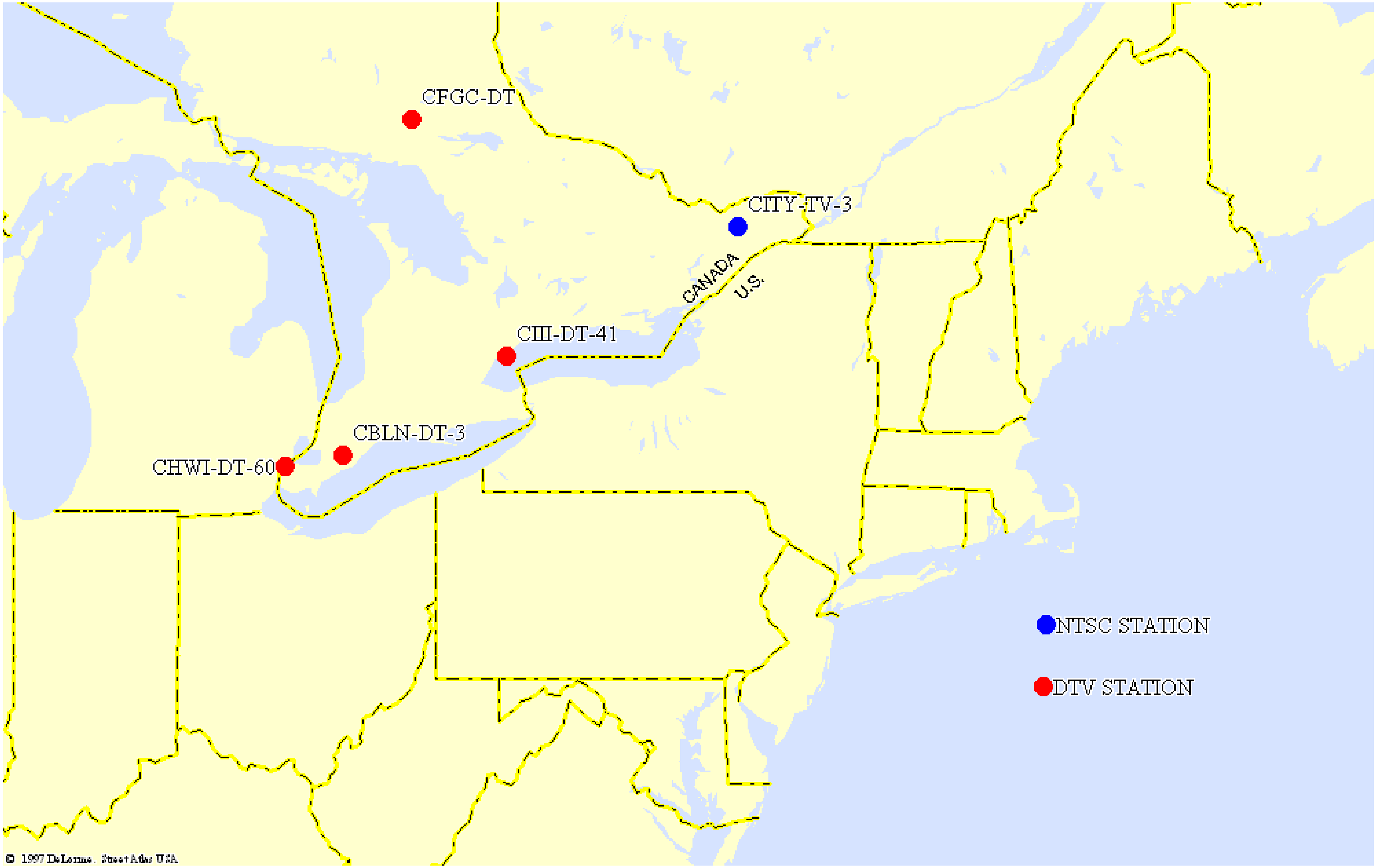
Channel 64


CANADA
UNITED STATES
CFGC-DT-2
CJOL-DT-14
CBVT-DT-7
CIVO-DT
CBFT-DT
CANADA
U.S.
CICO-DT-38
CBLT-DT
DTV STATION
© 1997 DeLorme. Street Atlas USA

Channel 65



CFGC-DT
CITY-TV-3
CANADA
U.S.
CIII-DT-41
CBLN-DT-3
CHWI-DT-60
NTSC STATION
DTV STATION
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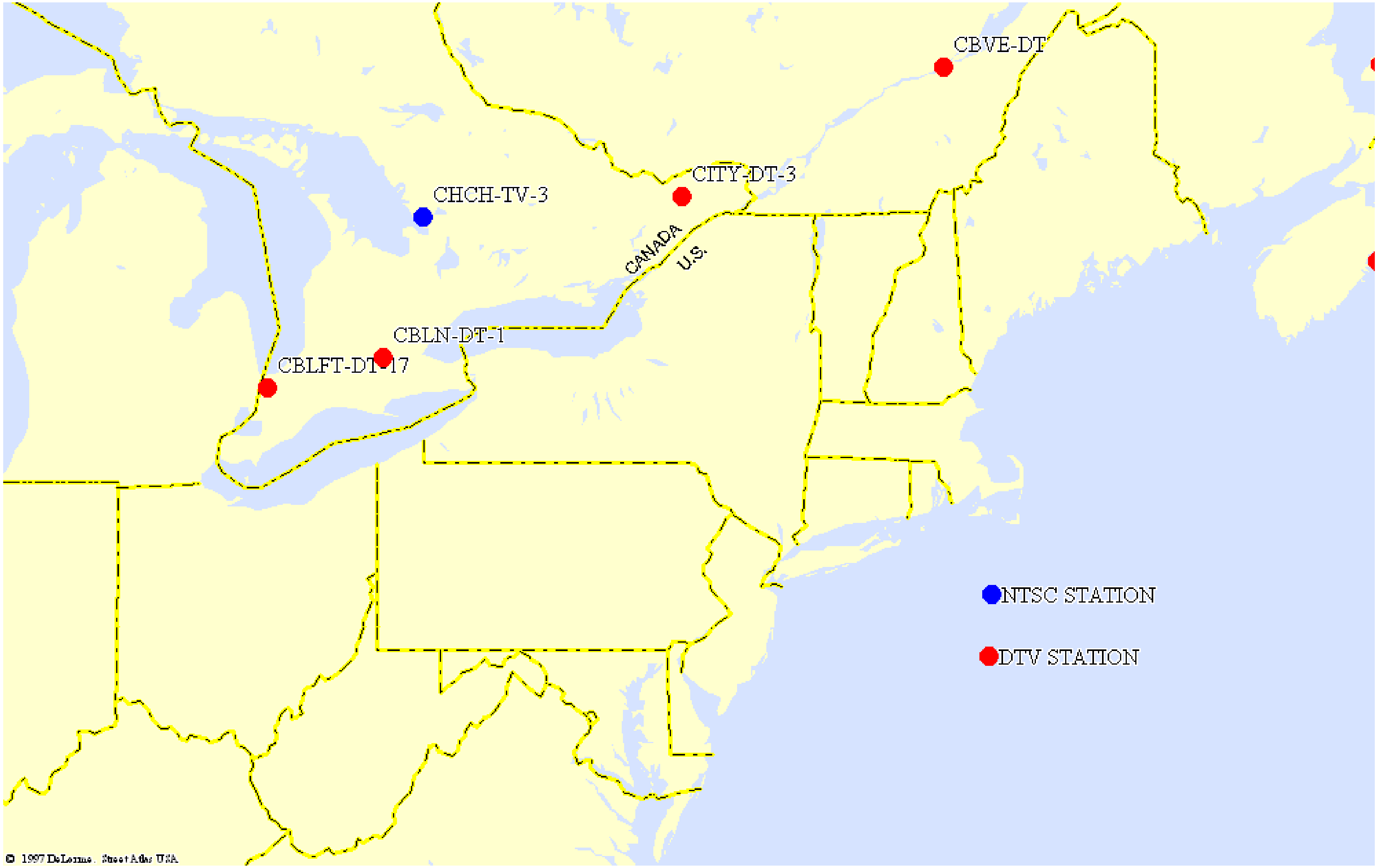
Channel 67


CBVE-DT
CITY-DT-3
CHCH-TV-3
CANADA
U.S.
CBLN-DT-1
CBLFT-DT-17
NTSC STATION
DTV STATION
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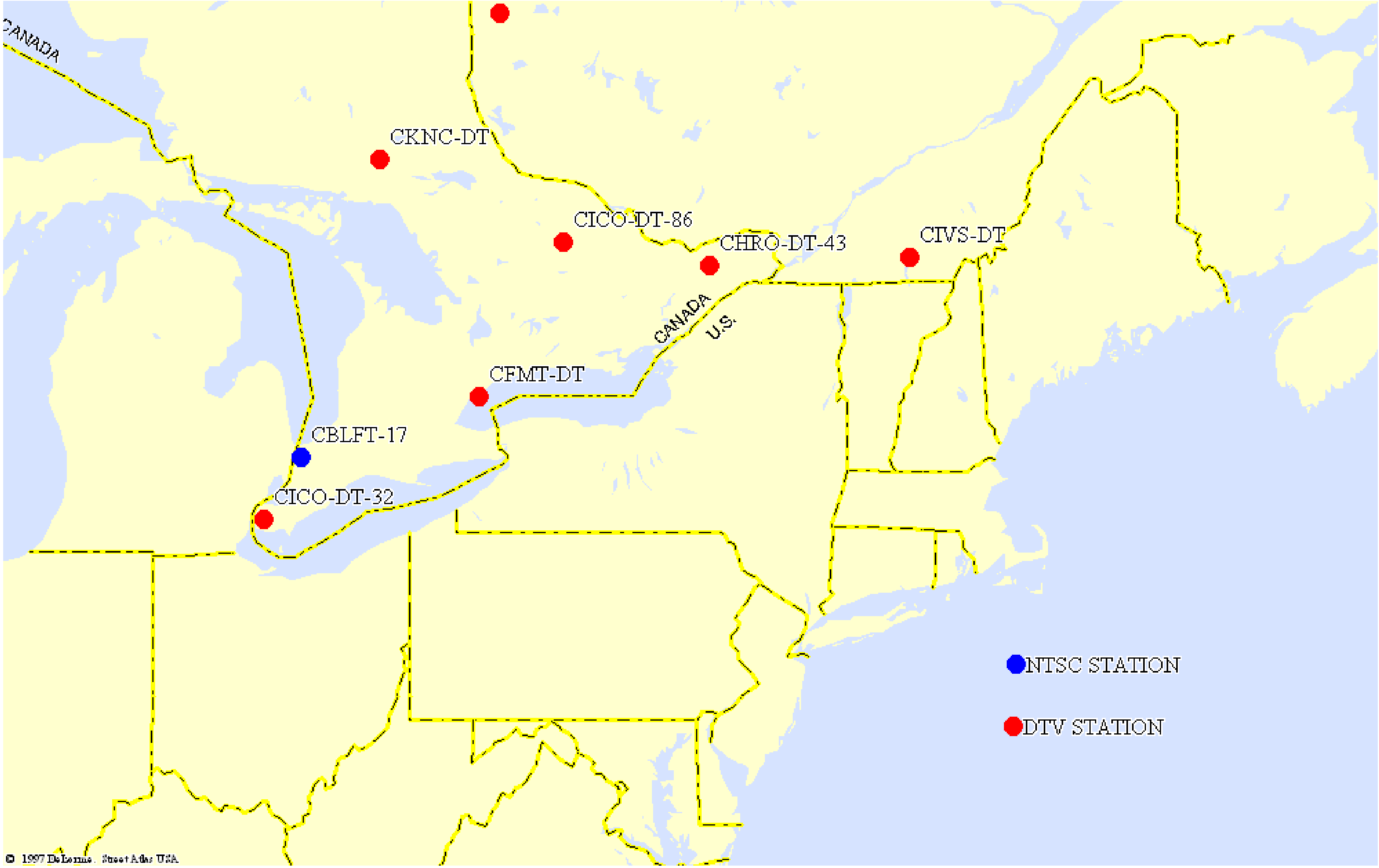
Channel 68


CANADA
CKNC-DT
CICO-DT-86
CHRO-DT-43
CIVS-DT
CANADA
U.S.
CFMT-DT
CBLFT-17
CICO-DT-32
NTSC STATION
DTV STATION
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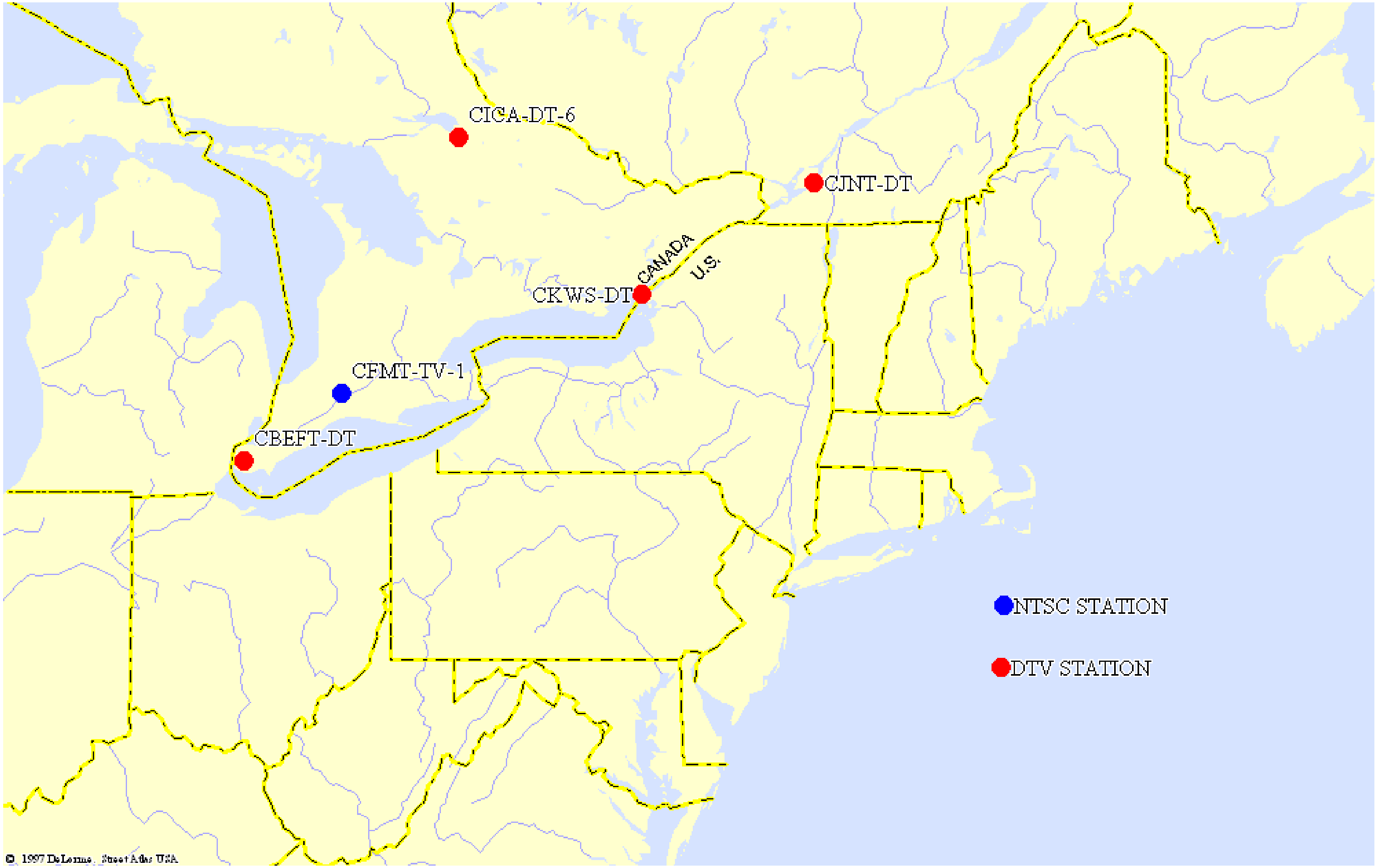
Channel 69



CICA-DT-6
CJNT-DT
CANADA
U.S.
CKWS-DT
CFMT-TV-1
CBEFT-DT
NTSC STATION
DTV STATION
© 1997 DeLorme. Street Atlas USA

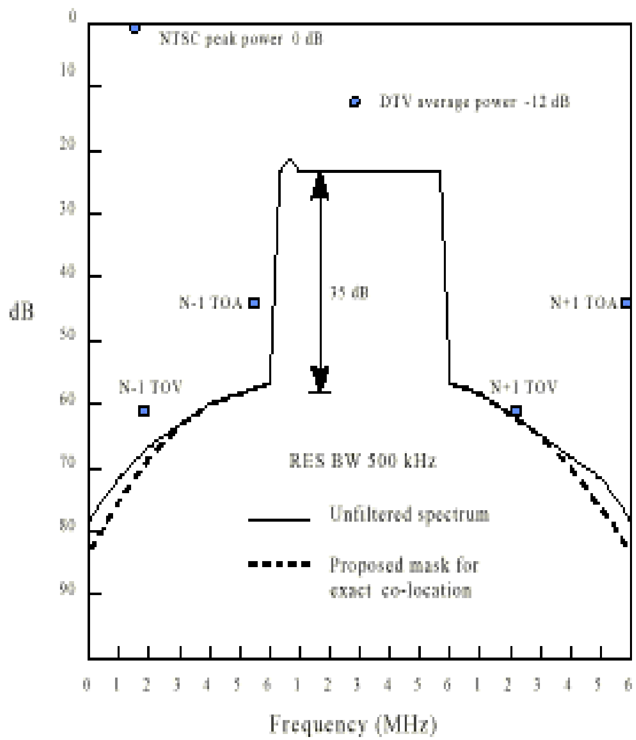


Figure 1: Unfiltered DTV spectrum and proposed "loose-mask" for exact co-location

Due to the essentially even power distribution of the DTV signal, interfering power into a narrow band channel is assumed to be the ratio of the respective bandwidths.
(i.e. 25 kHz / 6 MHz = 1/240
= - 23.8 dB)

{ 25 kHz was selected for NYS consideration of a 4-slot TDMA system application. However, it is acknowledged that Adjacent and Co-Channel LMR receiver thresholds (sensitivity and digital to digital interference.) used in this depiction are actually for 12.5 kHz Project 25 digital radios.
Ref: NTIA Report 99-358}

How Canadian DTV ERP was approximated

- NTSC parameters are available from the Canadian database.
- The distance to the Grade B contour was found by using the NTSC parameters in conjunction with the F(50,50) curves.
- At the new DTV frequency, the ERP was varied by trial and error until that same Grade B distance was replicated using F(50,90) curves at the reduced DTV receiver sensitivity level. (As specified in the Canadian publication “Digital Television Service Considerations and Allotment Principles” Prepared by JTCAB Ad Hoc Group on DTV Planning Parameters, August 1997.)
- The circular line about individual sites represents its Grade B Contour.

Power Thresholds

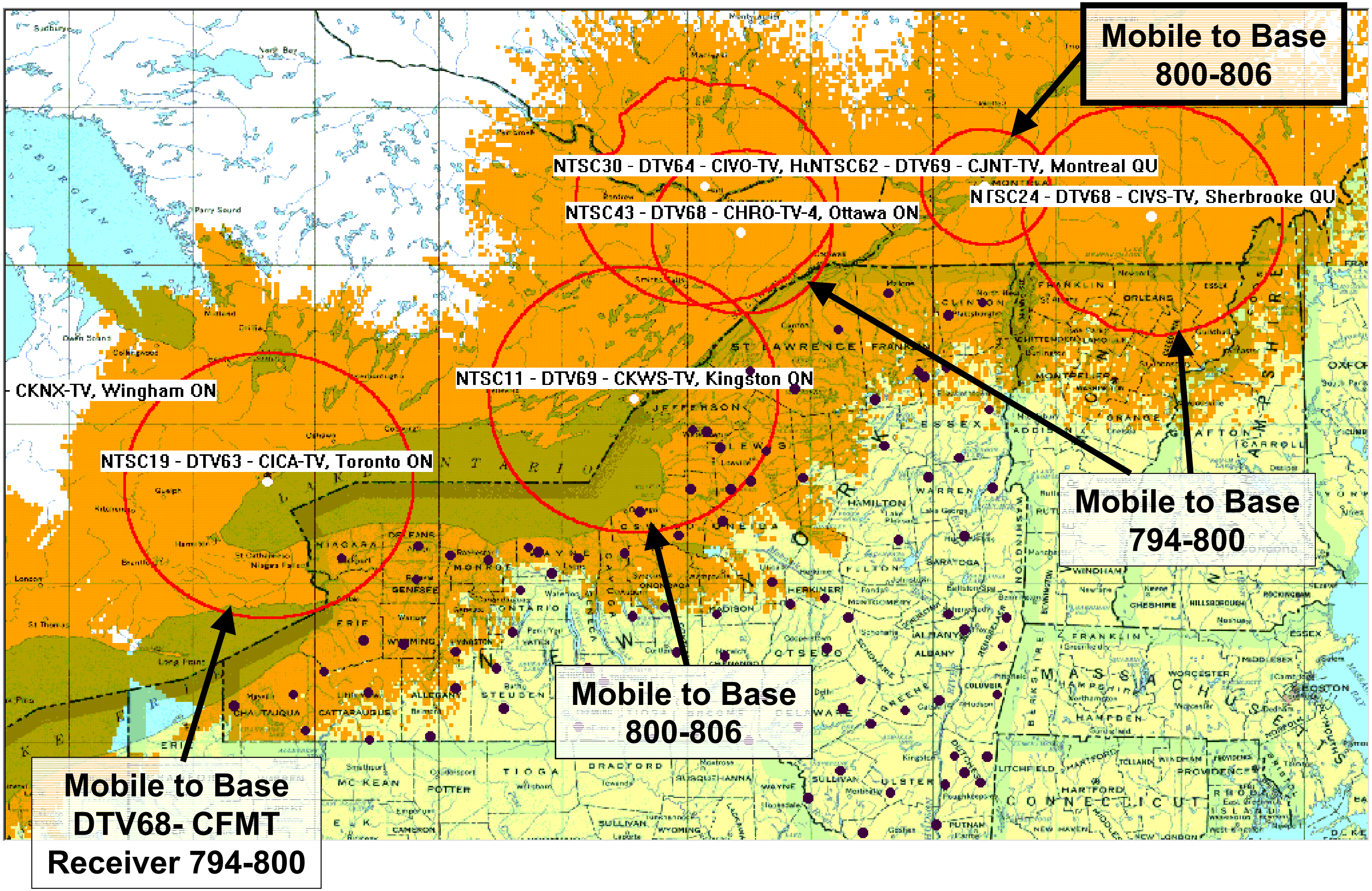
<u>DTV Co-channel at base receive, antenna 50 m above ground</u>

-121.4 dBm	Sensitivity at 5% BER
- 5.0 dB	Tower-top LNA noise figure improvement
- 10.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- 14.4 dB	Co-channel interference rejection ratio *
-130.6 dBm	**Tower Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

The following plots show Longley Rice prediction of signal strength.

Canadian DTV Co-channel at Towers (50 m) -130.6 dBm



While the ultimate channel plan is for base stations to receive on 794-806 (TV 68-69), the initial implementation may, for good cause shown, be different initially. [ref: 47 CFR 90.531(e)]

Therefore, any of these transmitters could have an impact upon base station receivers.

Several Canadian cities have multiple DTV channels proposed. The coverage plots shown above are reasonable representations of their impact upon U.S. public safety LMR use.

63 : Kingston, Toronto, Hull
(Also, Chatham - affects Michigan)

64 : Kingston, Toronto, Hull

68 : Ottawa, Toronto, Sherbrooke
(Also, Windsor - affects Michigan)

69 : Kingston, Montreal
(Also, Windsor - affects Michigan)

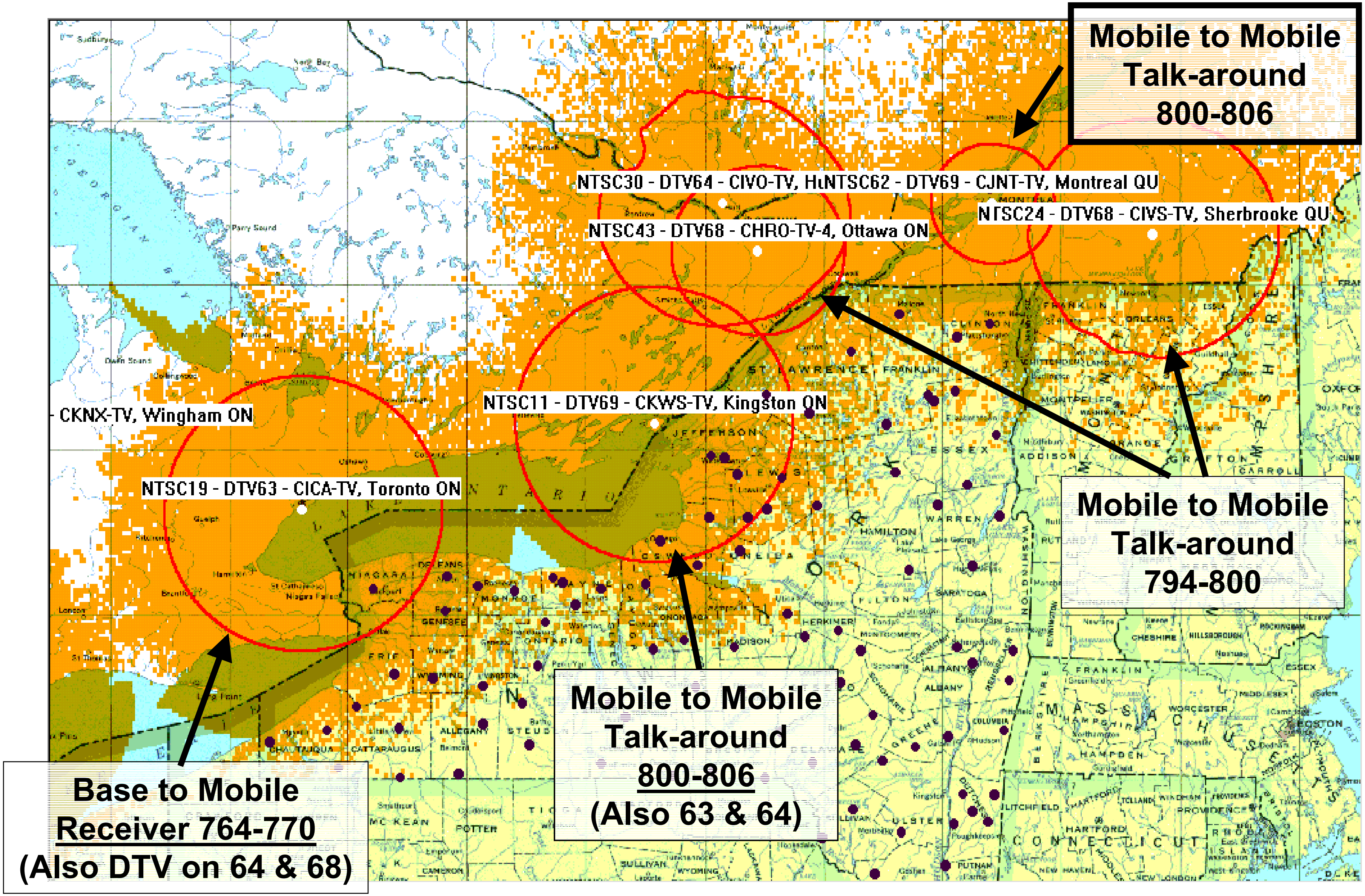
Power Thresholds

DTV Co-channel at mobile receive, antenna 2.2 m above ground

-121.4 dBm	Sensitivity at 5% BER
- 3.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- 14.4 dB	Co-channel interference rejection ratio *
-118.6 dBm	**Mobile Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

Canadian DTV Co-channel at Mobiles (2.2 m) -118.6 dBm



- An emission mask may be employed to prevent interference to Canadian DTV receivers from adjacent channel DTV/NTSC transmitters.

- The need for an emission mask is a function of whether the transmitters are co-located or distant from each other.

  - Co-located or distant adjacent channel DTV transmitters do not require . an emission mask.
  - Co-located DTV/NTSC transmitters require only a loose mask.
  - Distant (up to 5 miles) spaced DTV/NTSC transmitters require a tight mask.

- **In our adjacent channel analysis, we did not assume use of an emission mask**.

- **Two adjacent channel cases were examined:**
- **close freq. spacing to adj-channel (-35 dB)**
- **far freq. spacing to adj-channel (-55 dB)**

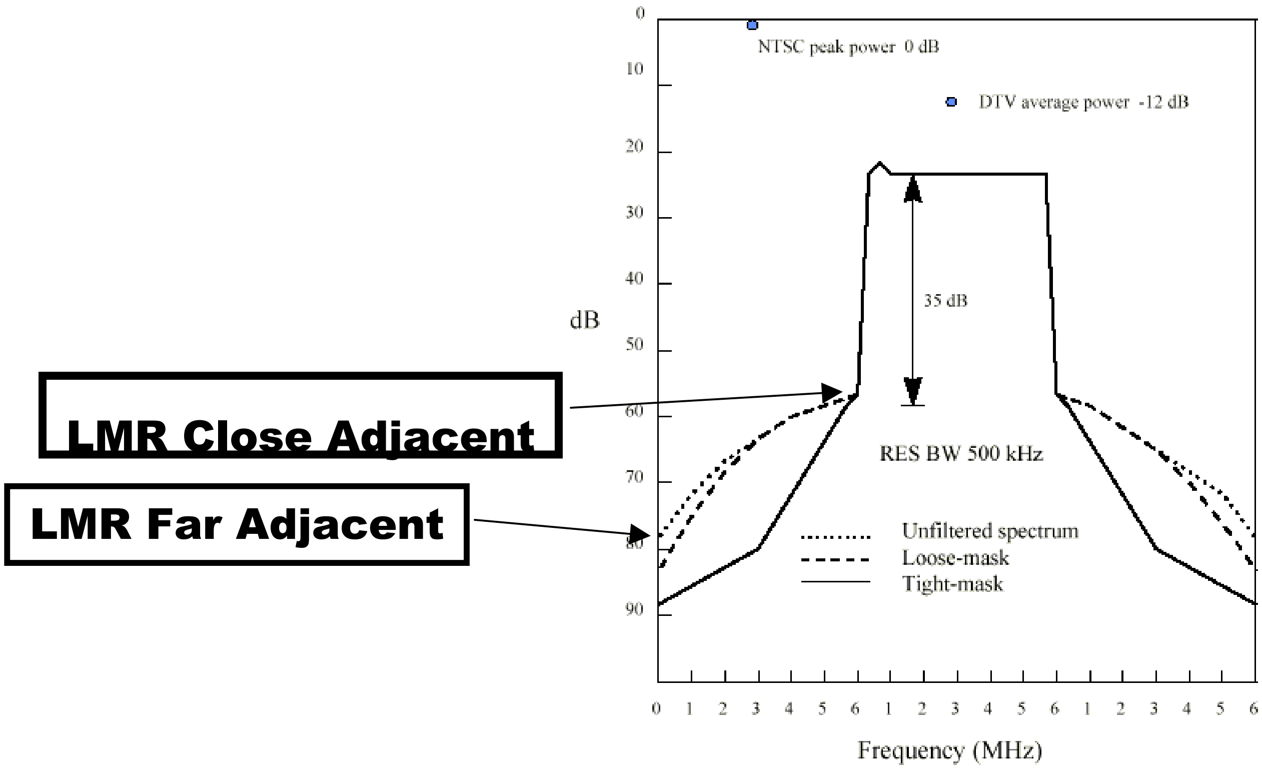


Figure 5: Proposed emission masks

Appendix 3
DIGITAL TELEVISION
Service Considerations and Allotment Principles
Prepared by
JTCAB Ad Hoc Group on DTV Planning Parameters
August 1997

Power Thresholds

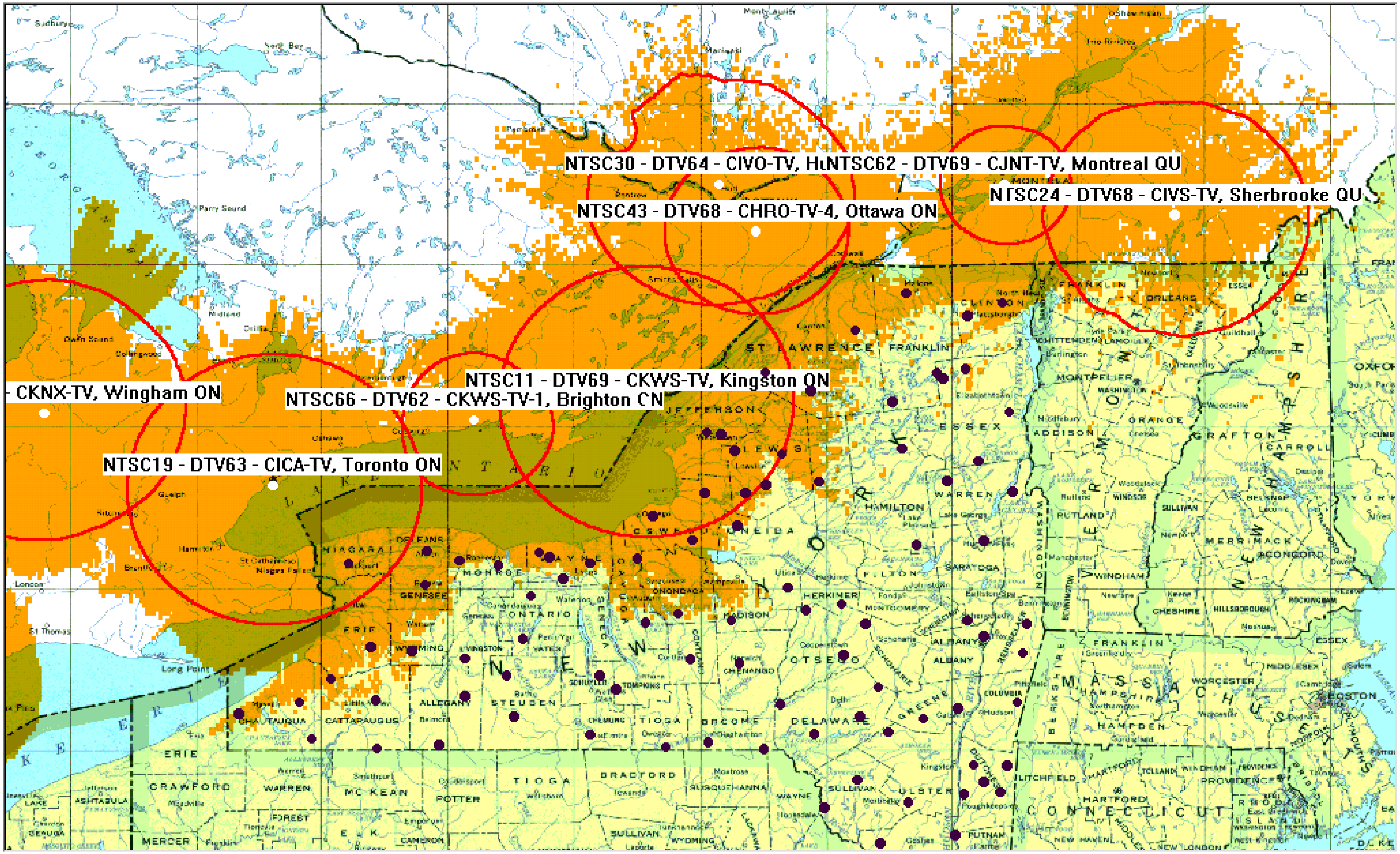
<u>DTV Adjacent channel at base receive, antenna 50 m above ground</u>

-121.4 dBm	Sensitivity at 5% BER
- 5.0 dB	Tower-top LNA noise figure improvement
- 10.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- (- 35.0) dB	**<u>Close</u>** sideband noise level
- 14.4 dB	Co-channel interference rejection ratio *
- 95.2 dBm	**Tower Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

The Co-channel interferer is the sideband noise of the adjacent channel DTV signal.

Canadian DTV
Close Adj-Channel at Towers (50 m) -95.2 dBm



Power Thresholds

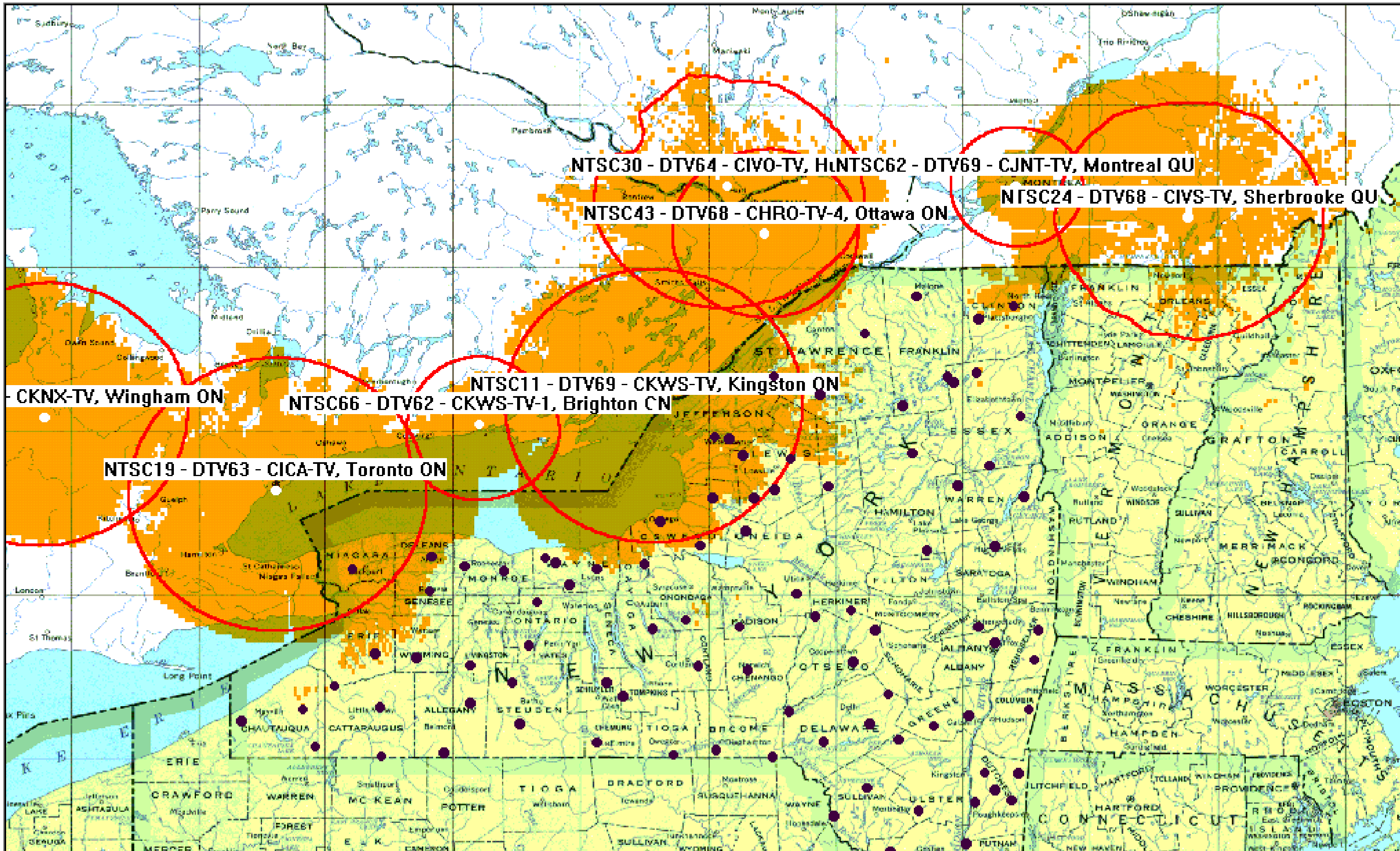
<u>DTV Adjacent channel at base receive, antenna 50 m above ground</u>

-121.4 dBm	Sensitivity at 5% BER
- 5.0 dB	Tower-top LNA noise figure improvement
- 10.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- (-55.0) dB	**<u>Far</u>** sideband noise level
- 14.4 dB	Co-channel interference rejection ratio *
- 75.6 dBm	**Tower Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

The Co-channel interferer is the sideband noise of the adjacent channel DTV signal.

Canadian DTV
Far Adj-channel at Towers (50 m) -75.6 dBm



Power Thresholds

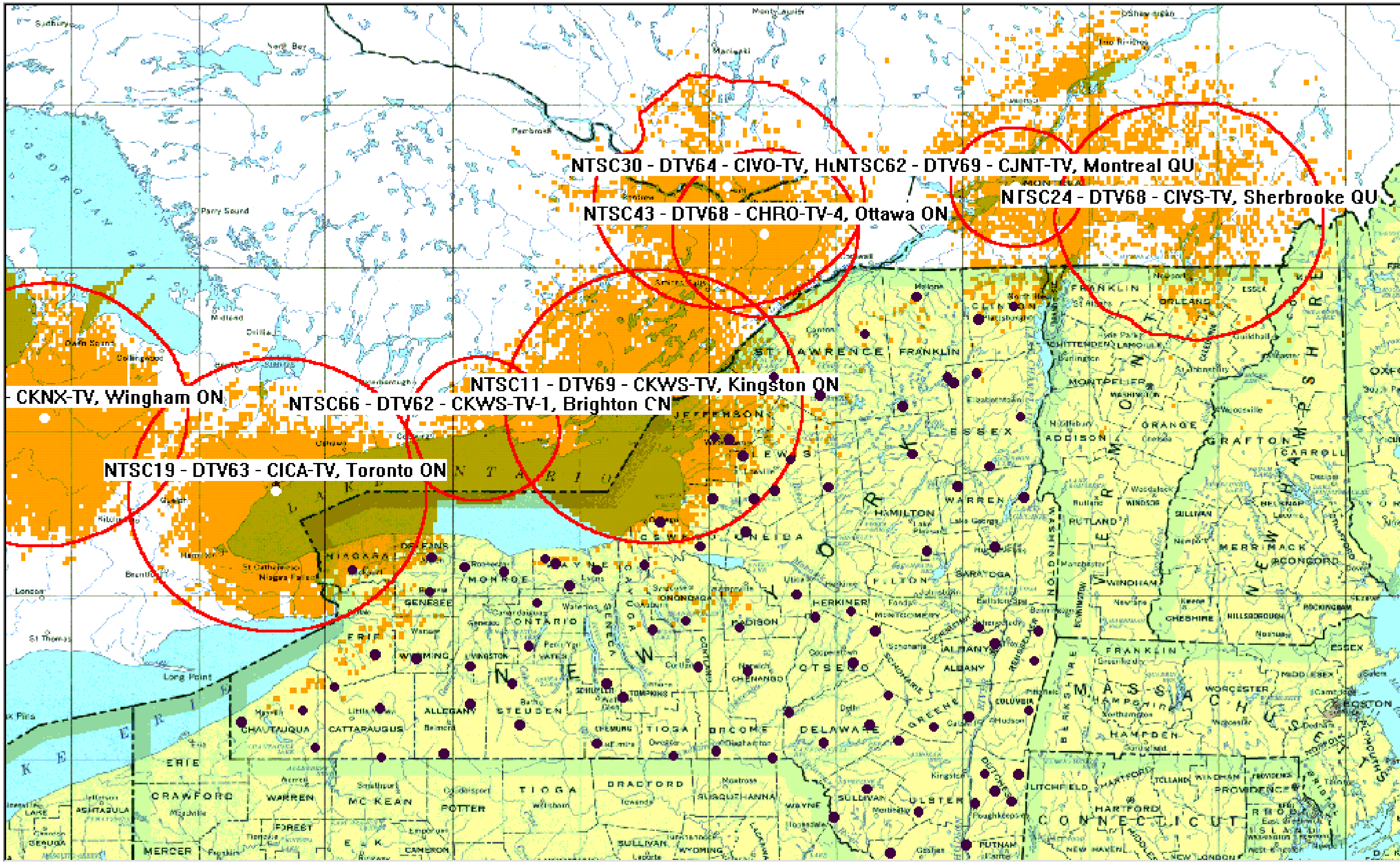
DTV Adjacent channel at mobile receive, antenna 2.2 m above ground

-121.4 dBm	Sensitivity at 5% BER
- 3.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- (-35.0) dB	**Close** sideband noise level
- 14.4 dB	Co-channel interference rejection ratio *
- 83.6 dBm	**Mobile Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

The Co-channel interferer is the sideband noise of the adjacent channel DTV signal.

Canadian DTV
Close Adj-channel at Mobiles (2.2 m) -83.6 dBm



Power Thresholds

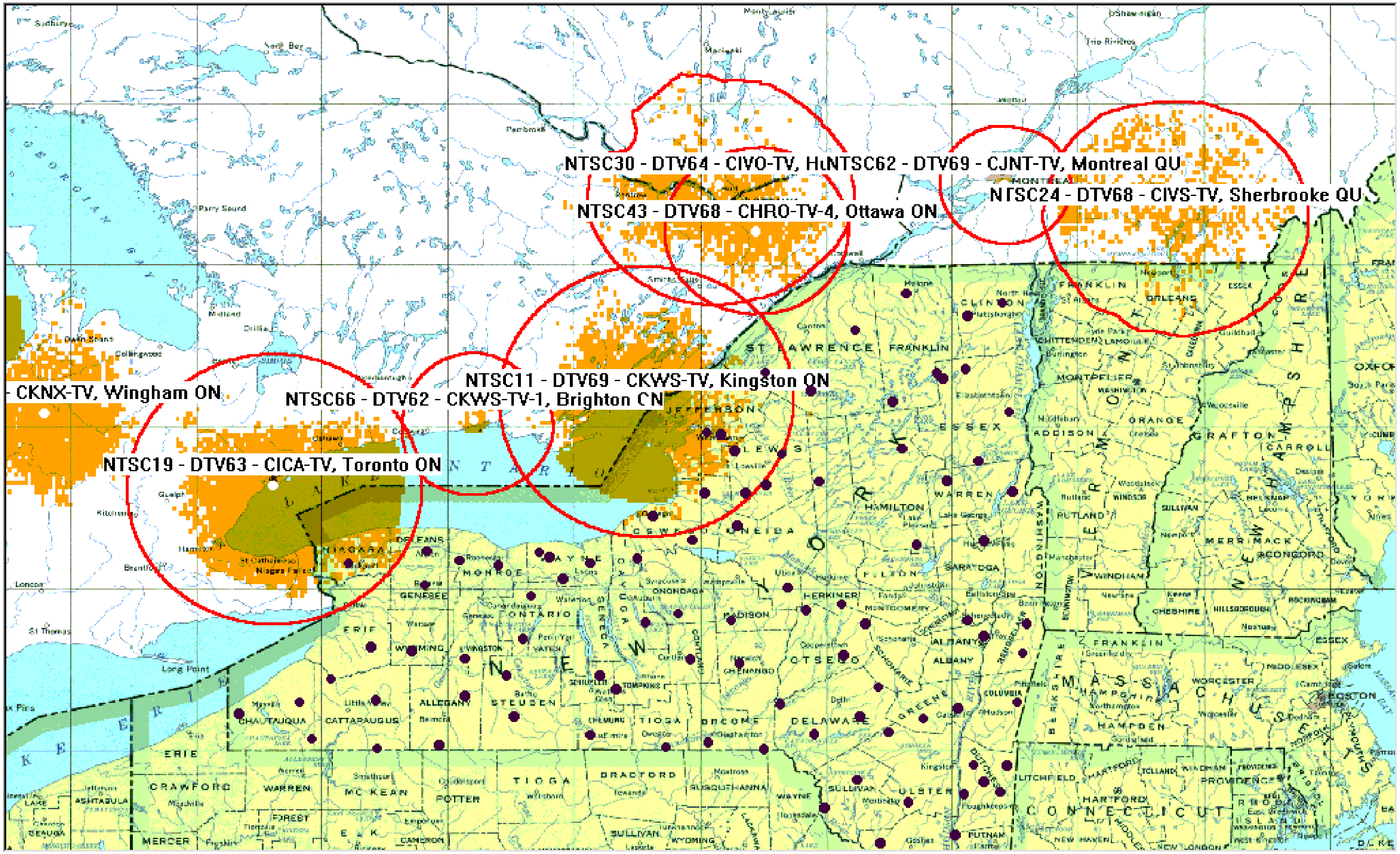
<u>DTV Adjacent channel at mobile receive, antenna 2.2 m above ground</u>

-121.4 dBm	Sensitivity at 5% BER
- 3.0 dB	Antenna gain
- (-23.8) dB	6 MHz to 25 kHz power reduction
- 3.6 dB	10% interference fade increase
- (-55.0) dB	**<u>Far</u>** sideband noise level
- 14.4 dB	Co-channel interference rejection ratio *
- 63.6 dBm	**Mobile Receive Interference Threshold**

* (P interferer - P desired) dB - NTIA 99-358 Table 3.

The Co-channel interferer is the sideband noise of the adjacent channel DTV signal.

Canadian DTV
Far Adj-channel at Mobiles (2.2 m) -63.6 dBm



MISCELLANEOUS ISSUES and CONCLUSION

- **Over-water signal propagation anomalies (eg. ducting) have not been taken into consideration. This phenomenon can significantly extend the range of radio signal interference.**

- **Certain assumptions and approximations were used, inasmuch as New York State was interested in a 25 kHz 4-slot TDMA technology and data was not readily available at the time for those adjacent and co-channel interference characteristics. However, the numbers used herein are believed to be reasonable approximations.**

- **Time sensitivity created by current regulatory and international negotiation activities required that preliminary analyses be presented as soon as possible to heighten the awareness of appropriate agencies to the significant impact of these issues.**

- **Clearly it has been shown that the sensitivity of LMR receivers in realistic system implementations needs to be taken into consideration, or else the new U.S. Public Safety band at 764-776/794-806 MHz will be unusable along large portions of the U.S./Canadian border area.**

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Spectrum Policy:	)	
	)	
Solicitation of Public Comment	)	ET Docket No. 02-135
by the Spectrum Policy Task Force	)	
	)	
	)	
To: The Commission		

COMMENTS OF

Statewide Wireless Network

New York State Office for Technology

6C Executive Park Dr.

Albany, NY 12203-3716

July 8, 2002

Appendix 8

Cover Letter - New York State's Analysis of the Canadian DTV Transition Allotment Plan and Recommendations - August 28, 2000

NYS·TEC

NEW YORK STATE STATEWIDE WIRELESS NETWORK OFFICE FOR TECHNOLOGY

August 28, 2000

Chairman William E. Kennard
Federal Communications Commission
445 12th Street, S.W., Room B201
Washington, D.C. 20554

RE: "New York State's Analysis of the Canadian DTV Transition Allotment Plan and Recommendations" – report on CD-ROM submitted herein

The State of New York is developing a multi-agency public-safety land-mobile radio network, called the Statewide Wireless Network (SWN), which, to be successful, will require the 700 MHz spectrum that is being released to public safety by the Commission as mandated by Congress. The current digital television (DTV) transition plan that enables the 700 MHz (TV channels 60 to 69) to be released does not take into account Canada's DTV plan. The consequence is that the states and provinces along the US/Canada border will not be able to utilize that spectrum for public safety and 3rd generation commercial wireless services.

A team from New York, along with other states, attended a briefing by the Commission on June 26, 2000 regarding the Letter of Understanding dealing with the Canadian DTV allotment table. Our team stated then that we believed a better plan could be developed that would satisfy the needs of the Canadians while allowing the US to utilize the spectrum as Congress intended. The State of New York has researched and performed detailed technical analyses of the issues and developed a set of recommendations, which are described in the attached report. Because of the length of the appendices (over 2300 pages) we have included a hard copy of only the narrative report here. The full report with all the appendices is on the CD-ROM. Complete hard copies, along with CD-ROMs, have been sent to Ms. Magalie Roman Salas, Secretary at the FCC and Richard B. Engelman, Chief, Planning & Negotiations Division, International Bureau at the FCC.

We respectfully request that the Commission review our findings and consider our recommendations.

Sincerely,

Scott R. Leonard
Communications Systems Center Director
The New York State Technology Enterprise Corporation (NYSTEC)

Enclosures

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